

SUPPLEMENT TO

Buick

**SELF-SHIFTING
TRANSMISSION
- MANUAL -**

**1938
SERIES 40**

**BUICK MOTOR DIVISION,
GENERAL MOTORS SALES CORPORATION
FLINT, MICHIGAN**

February 1, 1938

BPS 1.23

¶ This manual contains detailed service information which was not included in the original Self-Shifting Transmission Manual distributed in the beginning of the 1938 season. Therefore, the original manual should be retained for use in conjunction with this manual.

SPECIAL PARTS

Exclusive of Self-Shifting Transmission *Assembly, special parts required to replace standard production parts when Self-Shifting Transmission is used are as follows:

Flywheel housing.
 Clutch driven disc.
 Clutch release bearing support and spring washer.
 Transmission steady rest and rubber mountings.
 Torque tube assembly.
 Propeller shaft assembly.
 Differential case, ring gear and pinion.
 Speedometer drive and driven gears, flexible drive, flexible casing.
 (See page 15 for correct ratios.)
 Steering gear assembly.
 Throttle linkage and accelerator pedal.
 Front floor center panel.
 Front floor mat and its retainer at steering column.
 Combination fuel and vacuum pump.
 Hand control mounted on steering gear column jacket.

*See section on "Preparation of Service Transmissions," page 15.

SERVICE TOOLS

The following tools are available for servicing the 1938 Self-Shifting Transmission: (See Fig. 1)

TOOL NO.	DESCRIPTION
J-1120.....	Steering Wheel Puller
J-1121.....	Front Planetary Carrier Wrench
J-1122.....	Servo Cam Release Bar
J-1124.....	Front Bearing Snap Ring Expander
J-1125.....	Pressure Regulator Valve Nut Wrench
J-1126.....	Transmission Aligning Studs (2)
J-1127.....	Servo Gauge
J-1128.....	Cotter Pin Puller
J-1129.....	Transmission Hoist Complete
HMO-65-6	Pressure Valve Remover and Replacer
J-1138.....	Transmission Holding Stand
J-1139.....	Governor Removing Tool
J-1141.....	Governor Gear Removing and Replacing Plate
J-1142.....	Governor Adjusting Wrench
J-1146.....	Governor Setting Dial Gauge and Fixture
J-1147.....	Shifter Fork Ball Loading Tool
J-1148.....	Transmission Unit Lifting Hook
J-1173.....	Transmission Servo Band Clamps (2)

These tools are obtainable from Hinckley-Myers Company, Jackson, Mich.
 All Buick dealers should obtain the above tools or their equivalent.

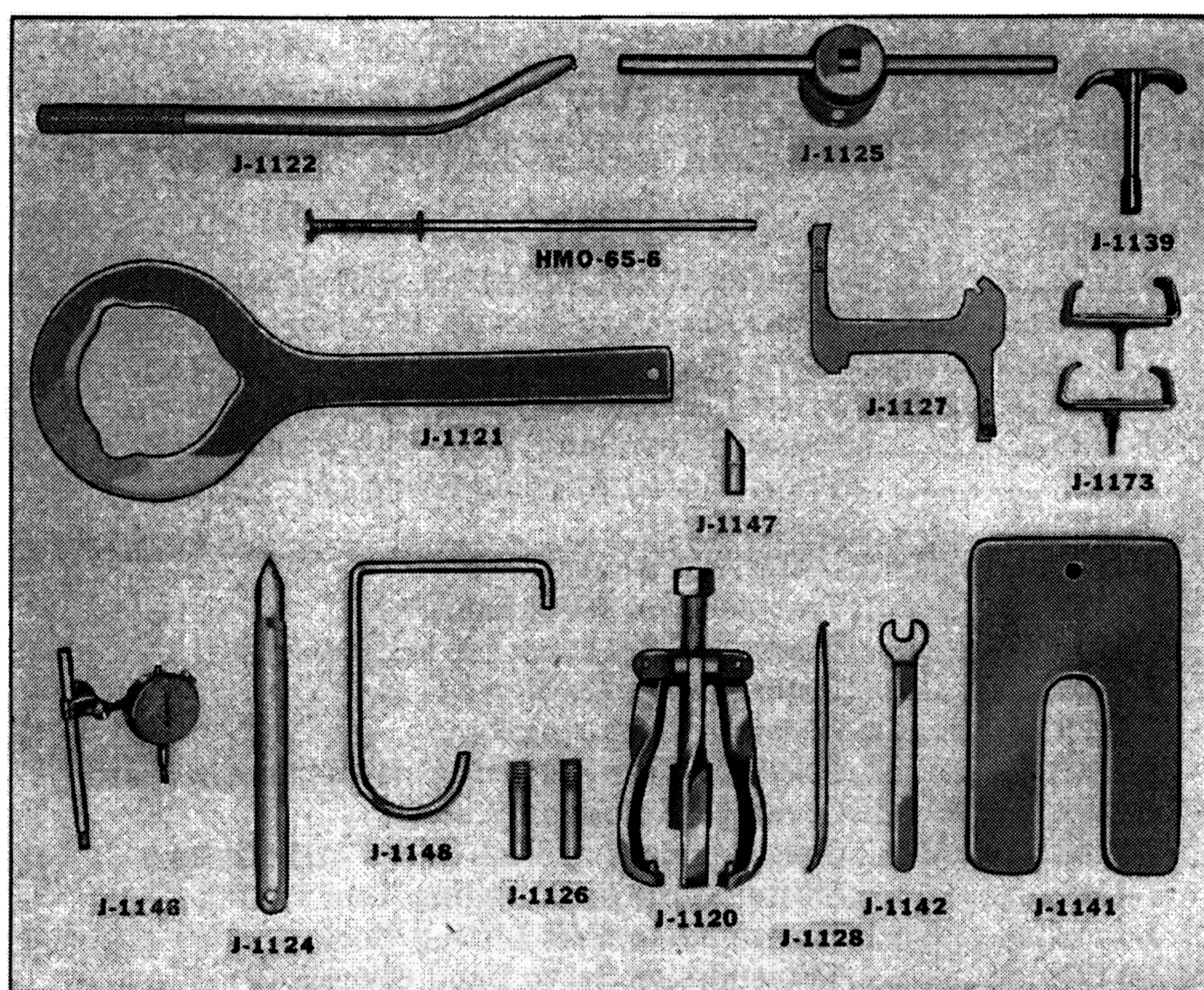
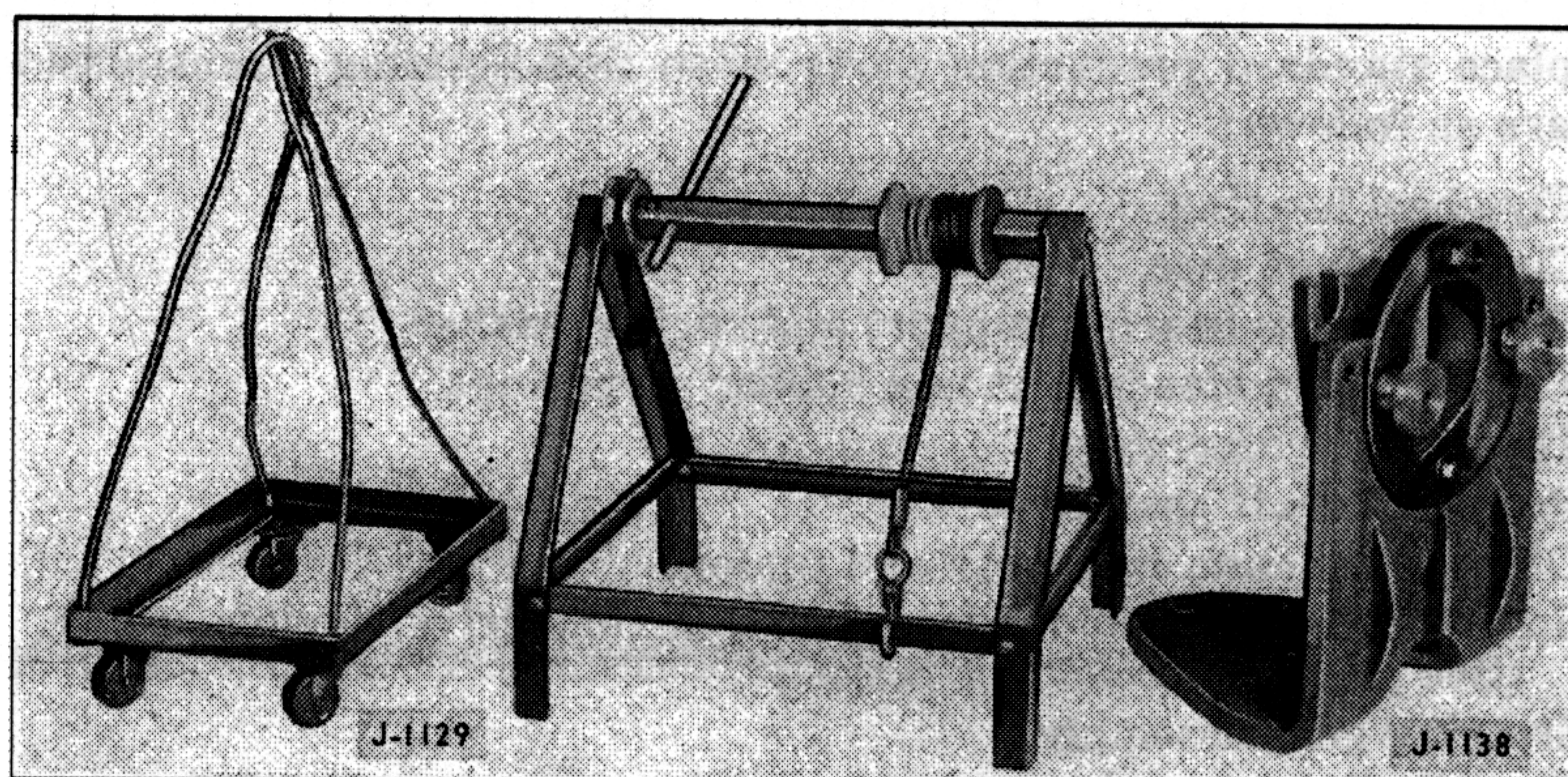


Fig. 1. Service Tools

IDLING SPEED

Idle speed must be from **5 to 6 M.P.H. in third speed.** (This engine speed is equivalent to 7 to 8 M.P.H. with synchro-mesh transmission equipped cars.) To be certain car is in third speed ratio, move shift control to second "F" (forward) position, accelerate to approximately 12 M.P.H. and allow car to slow down again to idling speed.

STARTING ENGINE BY TOWING

In case of necessity engine can be started by either towing or pushing car as follows:

1. Disengage clutch and move shift lever to high range position.
2. Tow or push car. When a speed of **at least 10 M.P.H.** is reached, turn ignition switch "on" and engage clutch. Engine will then be driven through 3rd gear.

TOWING

Transmissions Equipped with Double Drive Type Pump prior to following frame Nos.

1-_____ 2-_____
3-_____

(Above numbers will be supplied in Dealer Bulletin)

1. Disengage engine clutch and "block out" or fasten in this position. Attaching pedal to clutch linkage equalizer shaft will afford a satisfactory method of holding clutch in released position. It is not necessary to operate engine.
2. Move control lever to high forward range.
3. Tow car.

Transmissions Equipped with Single Drive Type Pump after the following frame Nos.

1-_____ 2-_____
3-_____

(Above numbers will be supplied in Dealer Bulletin)

1. Shift control lever to neutral position and tow car. Clutch release is not necessary.

PARKING

When parking car on a hill with engine turned off, putting control lever into either

Low Range or Reverse is equivalent to leaving car in "Low or Reverse Gear" for braking effect with a synchro-mesh transmission.

LUBRICATION

Transmission should be checked for oil level at pre-delivery and **every 1000 miles** thereafter and must be kept full at all times. If level is low there is danger of cavitating (sucking air) which causes transmission to shift to low gear with resulting severe car surge. The oil level stick, which is a unit of the transmission, is exposed when inspection hole cover is removed from center panel of front compartment floor, see Fig. 2. Oil is added to transmission through level stick hole.

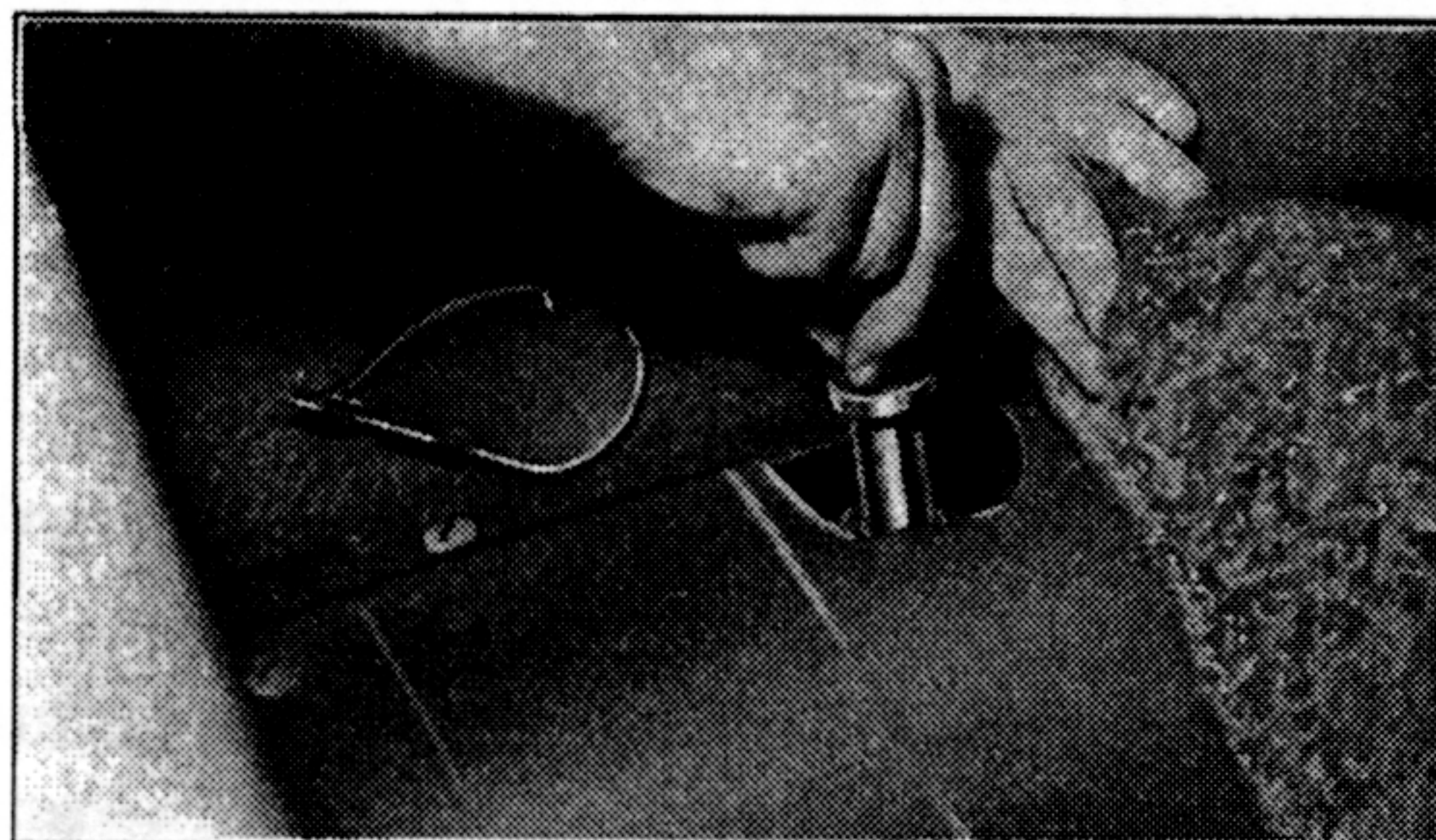


Fig. 2. Oil Inspection Hole

Oil should be changed at end of first 2000 miles and each 10,000 miles thereafter (each time pan is dropped to check servo bands). In addition, seasonal changes, based on minimum anticipated atmospheric temperatures, will be required. The following chart indicates grade of oil to be used at various temperatures:

MINIMUM	GRADE
If it is anticipated the minimum atmospheric temperature will be:	Use the grade of engine oil indicated:
32° F. and above.....	S.A.E. 30
10° F.	S.A.E. 20 or 20W
—10° F.	20W
Below —10° F.	10W

It is important that oil recommendation chart be followed closely. Deviation to a heavier than recommended oil will cause a drag and delayed shift (slipping) in the transmission during warm-up period when

starting car at low temperatures, with oil cold. Use of oils lighter than recommended, impairs the smoothness of operation of transmission particularly during and after a high speed run.

Seasonal oil changes require only the removal of drain plug at lower front of transmission for draining. Elevating rear of car facilitates this operation. Oil changes at time servo bands are reset, require removal of oil pan. Each time pan is removed it should be thoroughly cleaned to remove sediment and particles of the bronze clutch plates which scrape off during "wearing in" process. A new cork gasket should be used each time pan is replaced. Do not use shellac, permatex, or any sealer whatsoever on any transmission gaskets (except transmission to flywheel housing).

Capacity of transmission is approximately 3½ quarts when it is refilled after removing pan and approximately 3 qts. when only the drain plug has been removed.

Only oil marketed by reputable oil companies should be used. Never use transmission oils or oils containing special ingredients.

UNITS SERVICED WITHOUT REMOVAL

Some units may be serviced without removing transmission from car. The discussion immediately following concerns these units and it will be assumed transmission has not been removed.

Pressure Regulator Valve

Removal—See Fig. 3

1. Move front seat as far back as it will go. Remove floor mat (it is not necessary to remove accelerator pedal). Remove center floor panel.
2. Remove oil pressure regulator valve plug and spring, using tool No. J-1125.
3. Remove pressure regulator valve using tool No. HMO-65-6. The bumper or cushion spring should remain on valve as upper coil is designed to fit closely

on valve stem. It is important that spring is correctly assembled with tight coil on top.

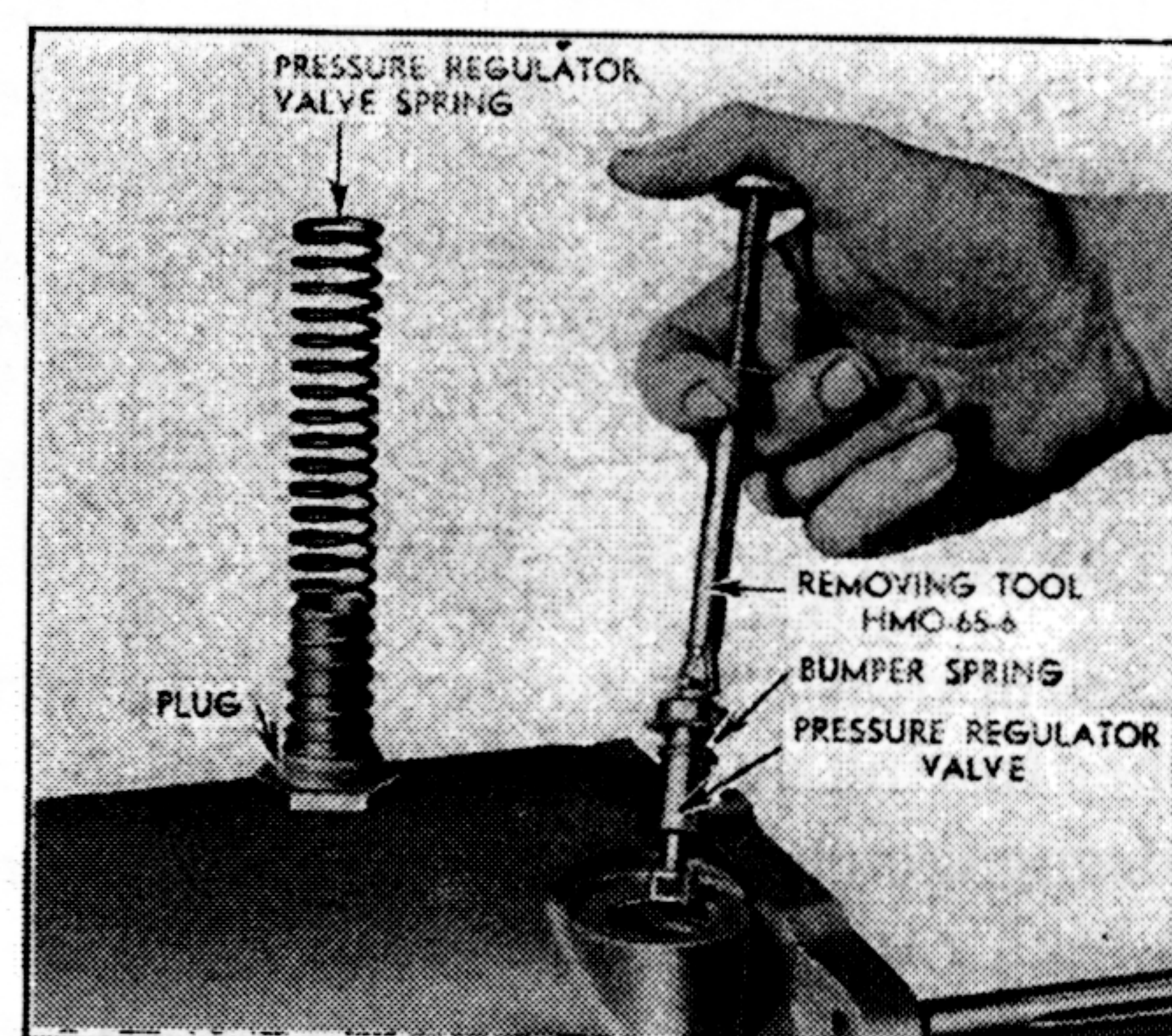


Fig. 3. Pressure Regulator Valve Removal

CAUTION

Care should be exercised when removing valve, that it is not dropped into transmission, as it then becomes necessary to remove oil pan to recover valve.

Installation

Reverse the removal procedure.

Service Information

The valve which is serviced separately, must operate freely in valve body without excessive clearance. (See clearance chart, page 36)

Both the pressure regulator valve spring and the bumper spring (the one which controls the pressure drop on deceleration) see Fig. 3, are available separately. The first type bumper springs have a tendency to take a "set" or lose their strength if subjected to high oil temperatures for any length of time. The indication of this defect is that down-shift from 3rd to 1st (caused by loss of oil pressure) on deceleration, occurs at a higher speed than normal.

Oil Pump (Double Drive Type)

Removal

1. Remove pressure regulator valve. (See "Pressure Regulator Valve, Removal.")

2. Remove oil pump to transmission case cap screws "A." See Fig. 4.

NOTE: The two cap screws near center of pump cover hold cover to pump body and need not be removed.

3. Remove oil pump and gasket. As oil pump is doweled to transmission case, it may become necessary to pry pump off dowel pin. After pump is off dowel pin, **care must be taken** not to force pump in any way, as this might cause considerable damage to bronze oil pump drive gears. If difficulty is encountered, turn jacked-up rear wheel slightly in either direction. This will line up the two pump driving gears and pump can then be removed without difficulty.

Disassembly

1. Remove the two pump cover to pump body attaching screws. (See Fig. 4.)
2. Remove oil pump cover and gasket.
3. With oil pump in an inverted position, all internal parts can be removed.
4. To disassemble large and small driving gear assembly, press shaft out of outer drive or serrated gear which drives small section of oil pump.
5. Remove pressure regulator valve body to pump cap screws.
6. Remove pressure regulator valve body and bronze separator plate.

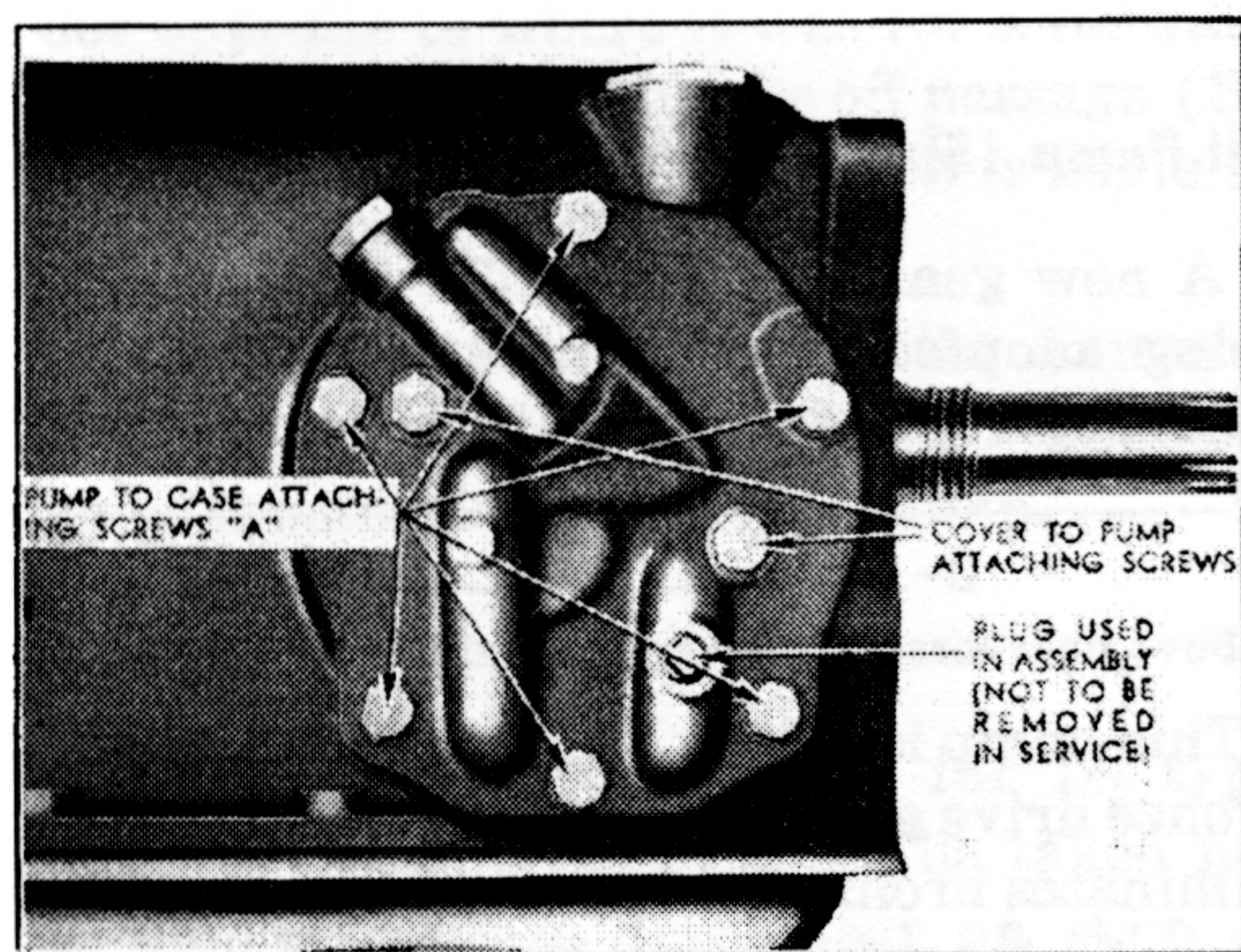


Fig. 4. Oil Pump Location

Assembly

1. Install pressure regulator valve body and bronze separator plate. Tighten cap screws evenly to prevent distortion in valve body. Make sure pressure regulator valve is free in body after all cap screws are tightened.

2. Reassemble large and small driving gear assembly.

NOTE: When pressing gear with serrated bore onto pump shaft, place a .010" feeler gauge between the two gears on outer end of pump shaft. Press gear onto shaft until a drag can be felt on feeler gauge. See Fig. 5.

3. Install pump gears into pump body.
4. Assemble pump cover using a new gasket. A leak at this point may cause a loss of oil pressure.

NOTE: Make sure that both sections of oil pump turn freely before installing in transmission.

Installation

Reverse sequence of removal operations, using new gasket and taking particular care that bronze drive gears are not damaged. Nicks on gear teeth may cause objectionable noise.

After installing pump, always jack up rear wheels in a safe manner and run trans-

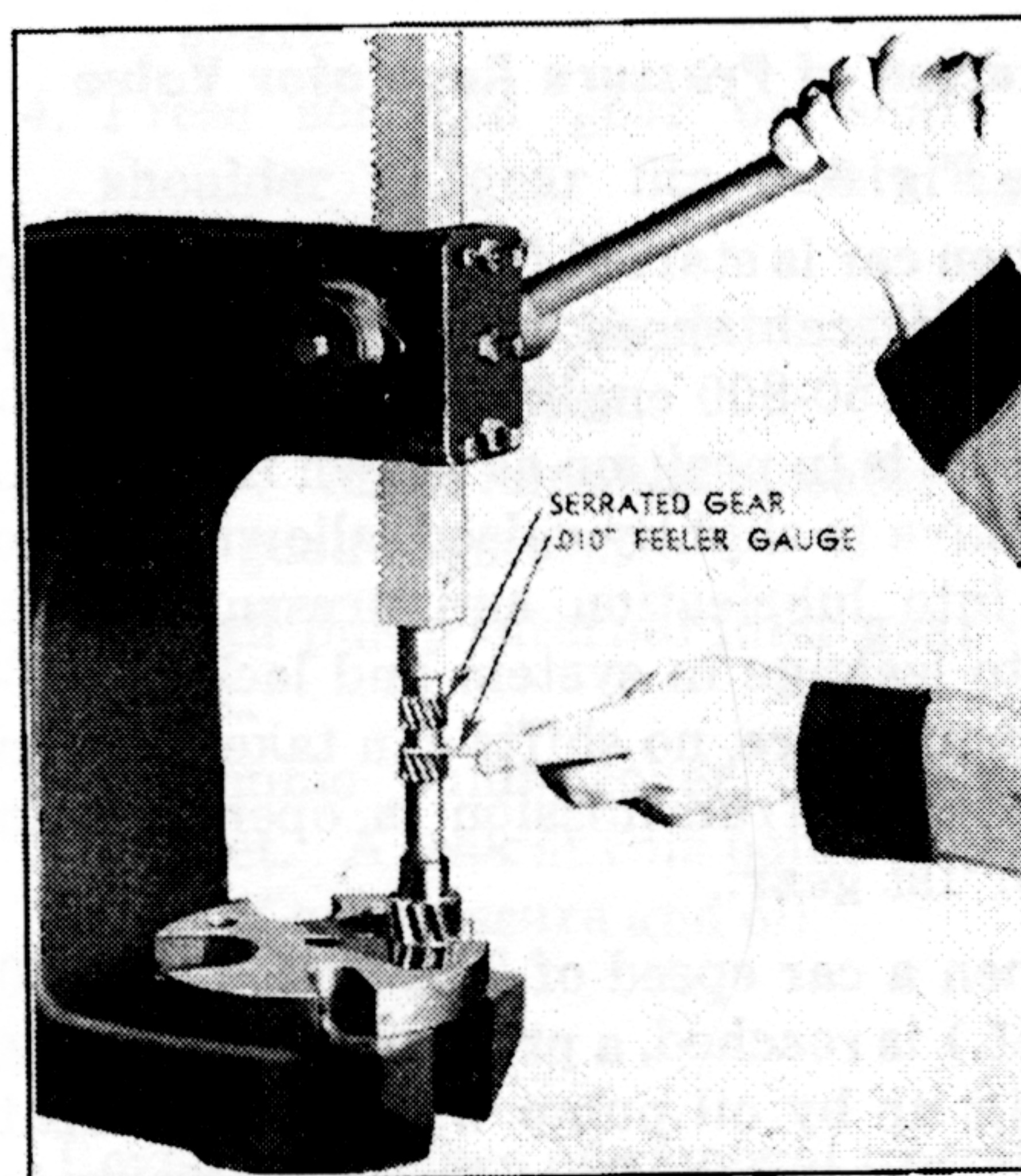


Fig. 5. Assembling Oil Pump Driving Gears

mission with shift lever in high range position. This will provide a check for oil leaks.

Service Information

The pump internal idler gears are available separately for service. These gears have a free fit on shaft which is pressed into pump body. To replace either or both internal driving gears, it will be necessary to perform operation No. 4 under "Disassembly."

After frame numbers 1-3234435, 2-3241974 and 3-3248397, an "out-board" bearing for the pump shaft was incorporated in production. This bushing is pressed into the pump cover and receives an extension of pump shaft. This new type cover can be used to service the old type cover.

The original .007" pump to transmission case paper gasket has been changed to vellumoid, .010" thick. This new gasket should be used for service in all cases.

It is very important that all pump working clearances be maintained, as failure to do so causes faulty pump action which in turn causes faulty operation of transmission. These clearances are shown in clearance chart, page 36.

Operation of Pressure Regulator Valve

See Fig. 6.

When car is started from a standing stop and until car speed of approximately 7 M.P.H. (750-800 engine R.P.M.) is reached, valve is in position as shown in View A. The valve is slightly raised, allowing oil to flow into lubrication and pressure lines. Due to leakage in system and lack of sufficient pressure, no shifts can take place in this stage. Transmission is operating in low or 1st gear.

When a car speed of 7 M.P.H. (750-800 R.P.M.) is reached, a pressure of 45 pounds is built up by oil pump which is sufficient to raise the valve. Once the valve starts to raise, the pressure build-up to 85 pounds is

very rapid, causing the valve to lift to its full pressure position. This movement is almost instantaneous. See View B. A relief valve in the lubrication line limits that pressure to 20 pounds which is sufficient to give ample lubrication without an excessive amount of oil being distributed. A by-pass to crankcase for excess oil supplied to regulator valve is also provided, see View B.

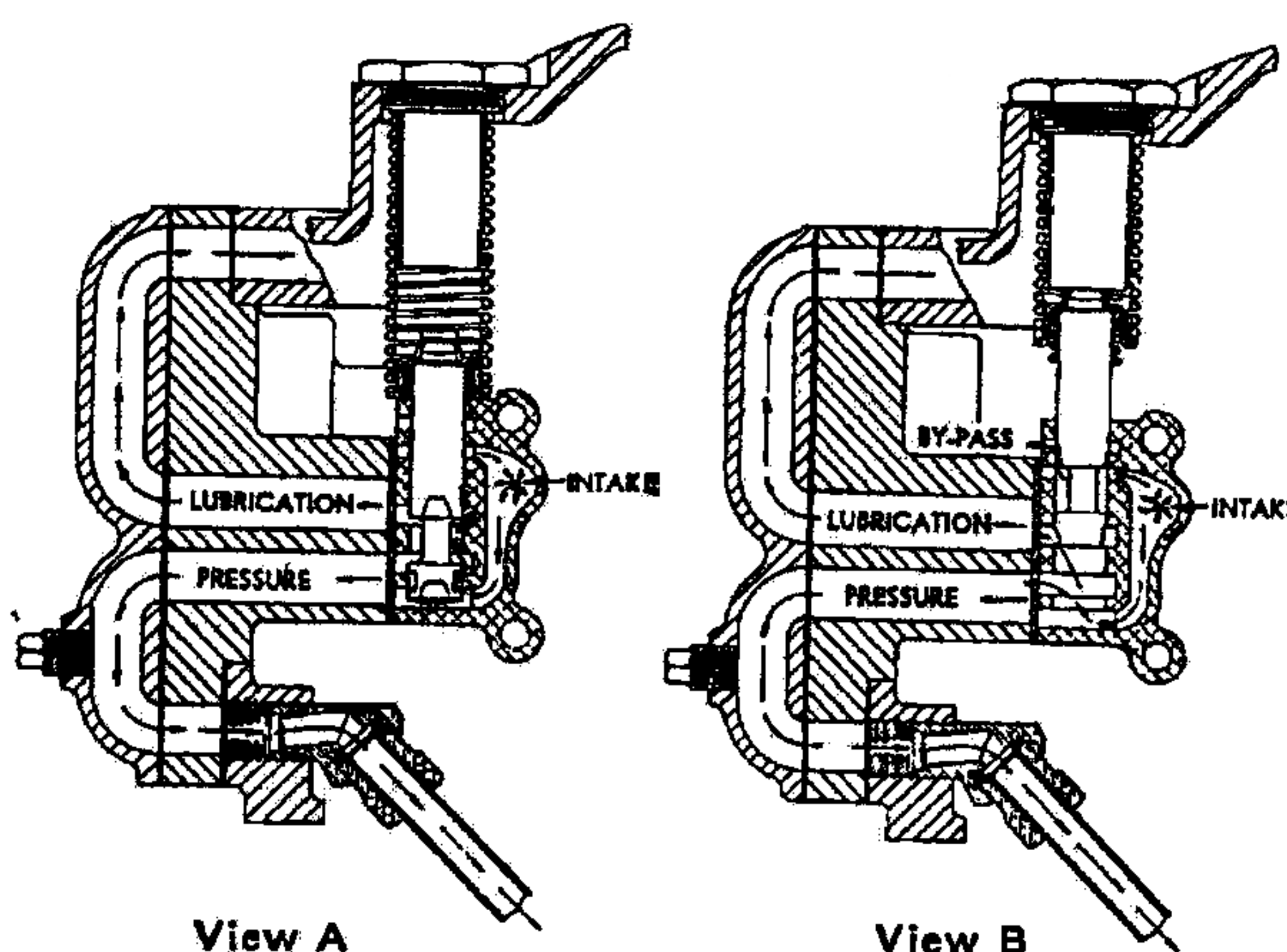


Fig. 6. Pressure Regulator Valve Operation

When car is being decelerated to a stop, valve will stay in its open or full pressure position until the pressure drops to 45 pounds at which point it drops, cutting off oil to operating and lubrication systems except for slight bleed as shown in View A. This valve drop should occur at approximate car speed of 3 M.P.H. (200 engine R.P.M.)

Oil Pump (Single Drive Type)

A new gear type reversible oil pump is being adopted in production for all Self-Shifting Transmissions after frame Nos. 1-_____ 2-_____

3-_____

(Above numbers will be supplied in Dealer Bulletin)

This pump is driven by the original single bronze drive gear on stem of front unit and eliminates bronze drive gear on the counter gear. Outboard bearing is also used on this pump.

Pump is operating whenever rear wheels are turning. **Pumps are interchangeable with double drive type for service.** When replacing old type pump with new one, it is not necessary to remove or replace either bronze drive gear.

Operation

With gears turning, corresponding to a forward motion of car, oil is drawn into pump through passage (A) see Fig. 7, View A, and forced out through passage (B). Oil pressure on piston type valve (C) forces valve against stop (D), blocking off passage (E) and uncovering outlet (F).

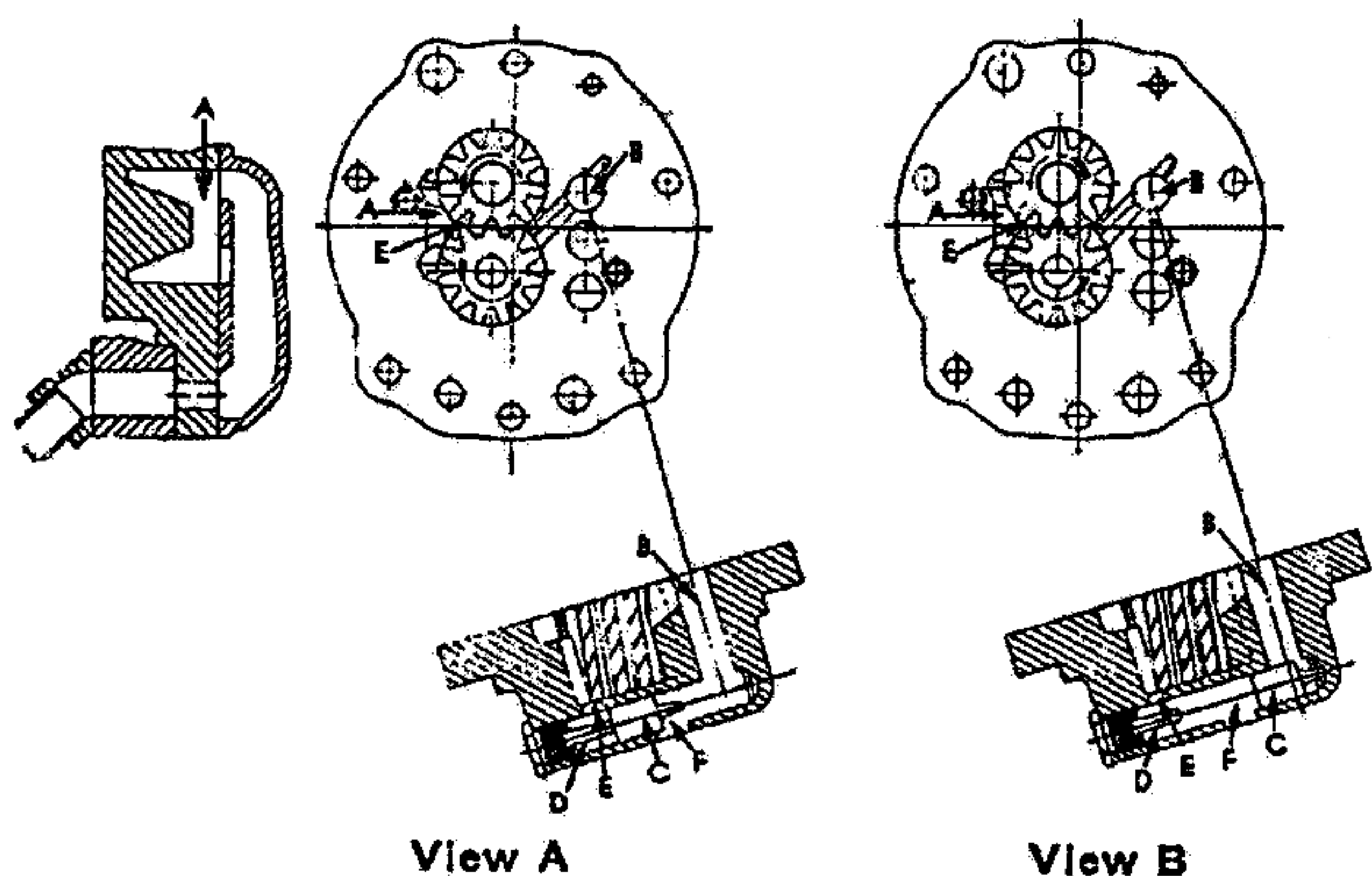


Fig. 7. Single Drive Oil Pump Operation

With pump gears turning, corresponding to a reverse motion of car, oil is drawn into pump through passage (A) see Fig. 7, View B, and forced out through passage (E). Oil pressure is directed to opposite end of valve (C), forcing it to end of cylinder opposite to where it was for a forward motion. Piston thus blocks off passage (B) and uncovers outlet (F) which is same as for forward motion.

After oil is in outlet (F), the course it follows to and through pressure regulating valve is same as for 1st type pump.

Removal

Follow same procedure as for 1st type pump, page 6. (Care should be taken not to damage bronze drive gear on stem of front unit.)

Disassembly

1. Remove the two pump cover to pump body cap screws.
2. Remove oil pump cover and gasket.
3. Press serrated oil pump driven gear from shaft and remove thrust washer and snap ring.
4. With pump in an inverted position, the internal gears can be removed.
5. Remove plug and shuttle valve from pump body.
6. To disassemble lubricating oil line relief valve, remove plug on side of pump cover and then remove regulator spring and plunger.
7. Remove pressure regulator valve body to pump cap screws.
8. Remove pressure regulator valve body and bronze separator plate.

Assembly

1. Install pressure regulator valve body and bronze separator plate. Tighten cap screws evenly to prevent distortion in valve body. Make sure pressure regulator valve is free in body after all cap screws are tightened.
2. Insert shaft with internal drive gear in pump body.
3. Assemble snap ring and thrust washer on shaft.
4. Press serrated gear on shaft until shoulder of gear fits firmly against thrust washer.
5. Install plunger, regulator spring and plug in pump cover.
NOTE: Make sure brass sealing gasket is in good condition.
6. Install pump internal idler gear on its shaft.
7. Assemble pump cover, using a new gasket. A leak at this point may cause loss of oil pressure and oil.

Installation

Reverse sequence of removal operations, taking particular care that bronze drive

gear is not damaged. Run transmission in high range position with rear wheels jacked up in order to check for oil leaks.

NOTE: Use a new pump to transmission case gasket.

Service Information

Maintenance of specified clearances in this pump is extremely important. End-play limits are from .001" to .003" and should be set with an indicator each time pumps are disassembled and reassembled. Two pump cover to body gaskets of different thicknesses have been released to make proper adjustment of end-play and are identified as follows:

0 notch	.007" thick
1 notch	.005" thick

Only one gasket should be used.

The following parts have been released for service:

Oil pump body assembly with bushing and idler gear shaft.

Idler gear.

Reversing valve and plug.

Internal drive gear and shaft.

Oil pump shaft thrust washer and retainer.

Pump cover assembly.

Serrated drive gear.

Internal gears are furnished only in matched sets.

NOTE: In conjunction with the change in oil pump, a clutch gear brake is being

adopted to reduce clutch spin which is introduced by eliminating oil pump drive gear on counter gear. This brake consists of a dished bronze friction washer and assembles between the inside face of clutch gear and splined stem of the front unit drive gear. Tangs or lugs on convex side of washer fit into milled slots on front unit drive gear. The inside face of clutch gear is ground to provide a friction surface for concave side of washer. When engine clutch is disengaged, the force of friction applied to clutch gear by the washer is sufficient to immediately stop its rotation.

This friction washer is not available for service when new pump is installed in place of double drive type, unless clutch gear and front unit drive gear are also replaced.

Servo Units—Removal

1. Remove drain plug and drain oil from transmission. Replace plug.
2. Remove oil pan. Each time pan is removed, it should be thoroughly cleaned to remove sediment, etc.

NOTE: Remove oil stick.

3. Remove oil pressure line (oil pump to front servo). See Fig. 8.
4. Remove oil suction pipe. See Fig. 8.
5. Loosen lock nuts and back off on adjusting screws until both bands are loose. (See Fig. 9.)
6. Loosen all servo to transmission case attaching bolts evenly to prevent bend-

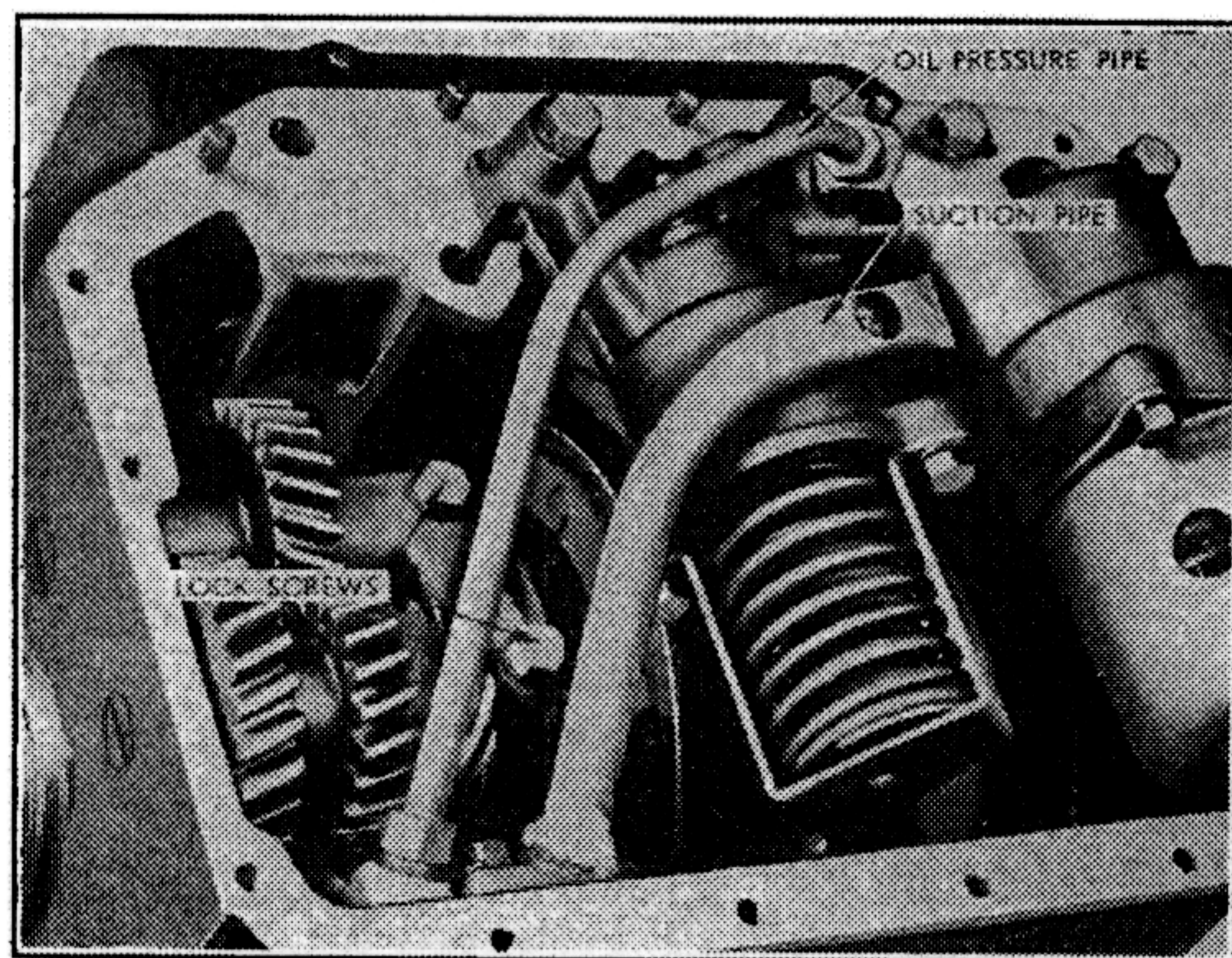


Fig. 8. Oil Pipes and Shaft Lock Screws

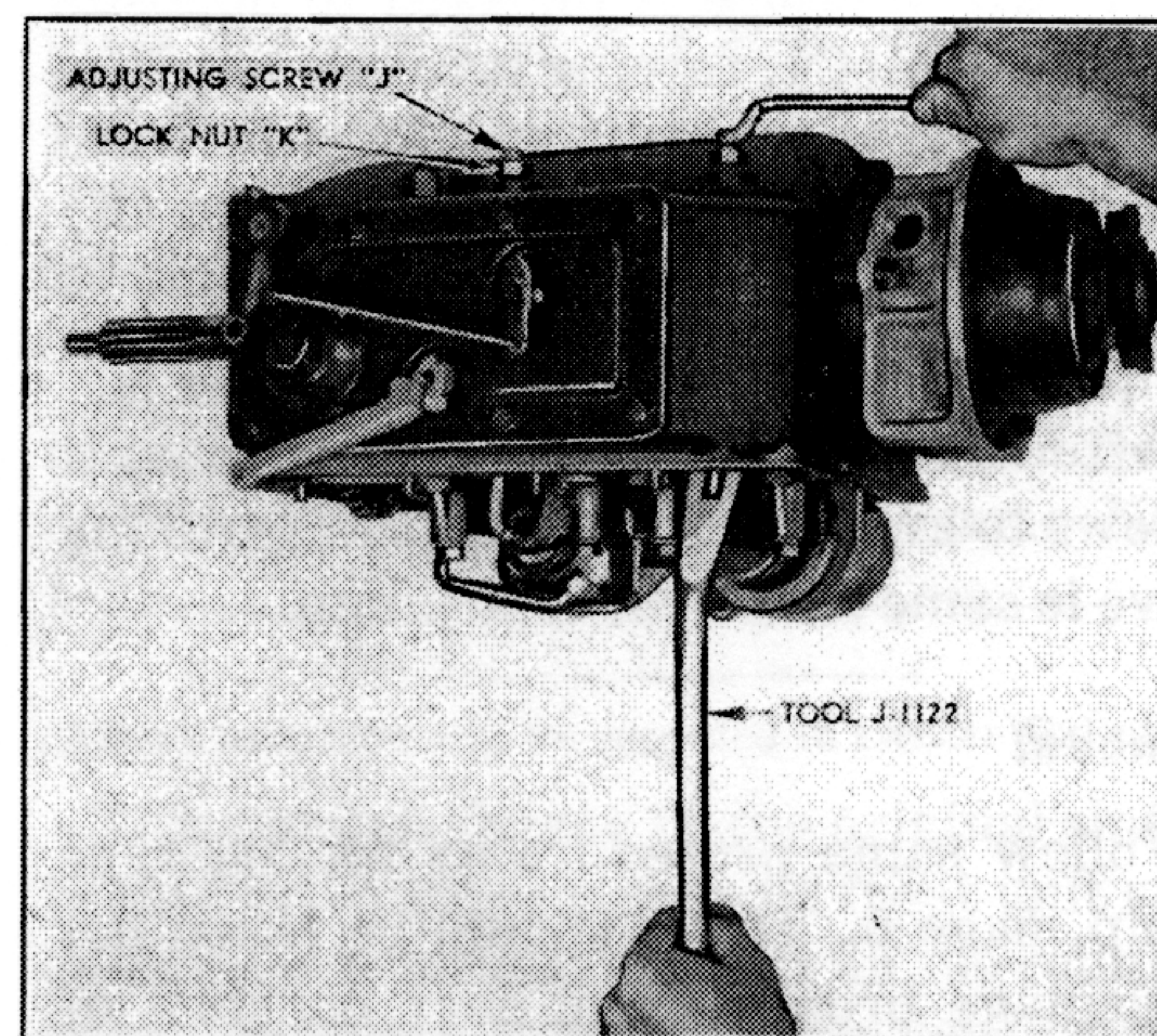


Fig. 9. Servo Band Setting

ing of connecting tubes. Remove rear servo attaching bolts, leaving front servo bolts in place.

7. Remove rear servo assembly by sliding it towards rear of transmission until connecting pipe between servos is free.
8. Remove front servo attaching bolts and then remove servo. Care should be taken not to damage the two oil delivery pipes which enter front servo when removing same. Rear servo can be removed without disturbing front one, but to remove front servo it is necessary to first remove the rear one.

Disassembly

1. Clamp unit (front or rear) in an arbor press.

CAUTION

Never try to disassemble servo without first clamping it in some suitable fixture such as an arbor press. The release of tension on the springs without some method of controlling them, would allow springs to fly, endangering anyone in the vicinity.

2. Remove bolts attaching spring retainer to servo body.
3. Raise arbor press head slowly until all springs have been extended their full length.
4. Remove spring retainer and springs.
5. Remove pistons. In rear unit this compound piston is in two parts. Front unit piston is in one piece.

Assembly

1. Center piston ring or rings on smaller piston before attempting to assemble pistons to cylinders. The chamfer on end of cylinder will compress a centered ring but not one off center.
2. Compress large piston ring and force piston assembly into cylinders by means of light taps on end of large piston.
3. For remaining assembly operations, reverse disassembly procedure.

Installation

To install servo, reverse sequence of operations for removal, making sure that brake band struts are located in actuating levers properly, see Fig. 10, and that oil

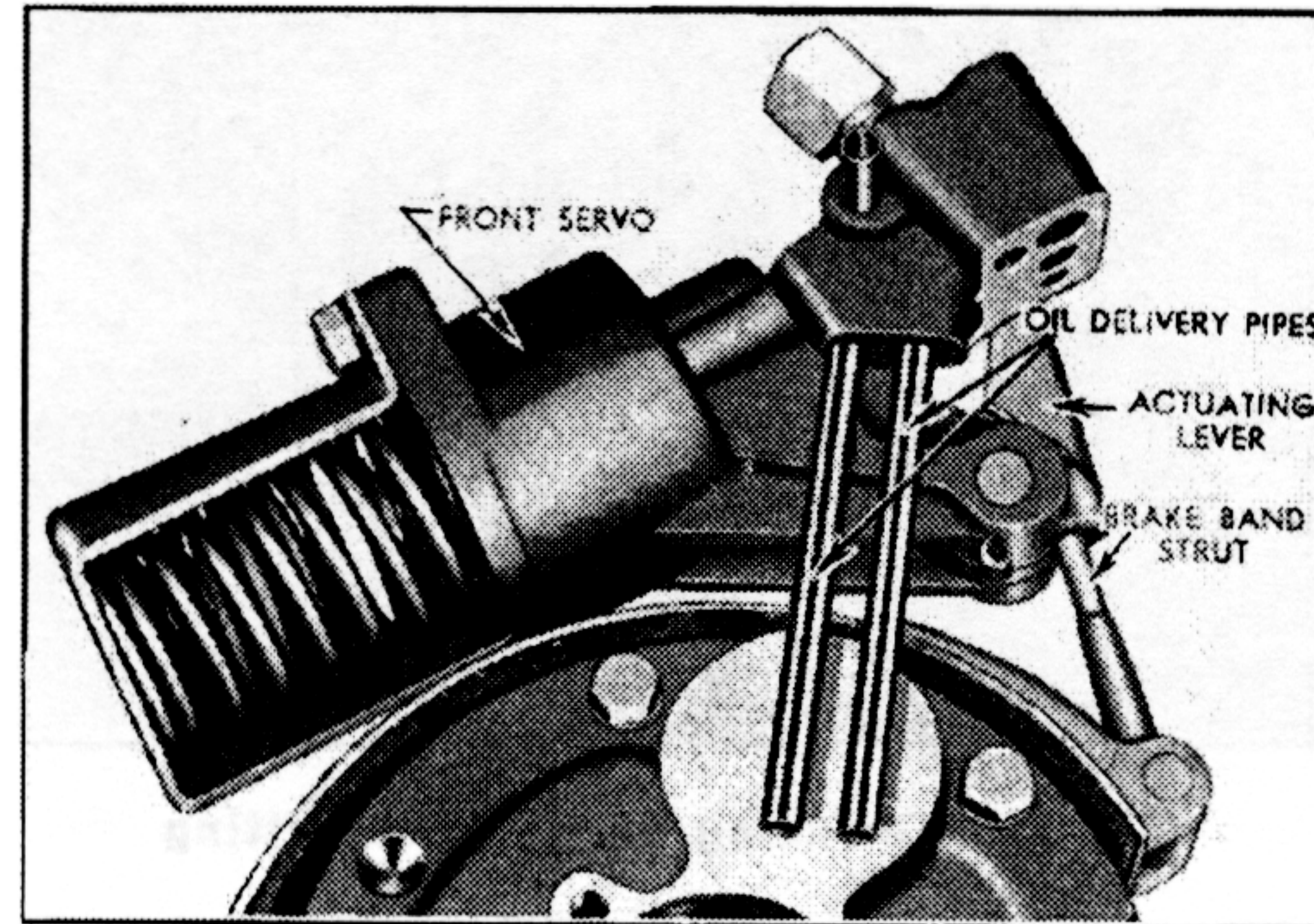


Fig. 10. Servo Installation

delivery pipes are in place. Servo to transmission case attaching bolts should be tightened evenly to prevent distortion of oil pipes.

Band Setting

The setting of both front and rear planetary unit servo bands will be made at completion of first 2000 miles (to take up for initial wear) and each 10,000 miles thereafter or when setting has been disturbed for any reason. (The 2000 mile setting is a part of the 2000 mile inspection on Self-Shifting Transmission equipped cars. See Dealer Bulletin, BPS 2.015, pages 390 and 391.)

PROCEDURE

1. Protect front cushion with cover, remove floor mat and center floor panel. (Two mechanics are required for remaining operations—one to remain in car, the other under car.)
2. Raise car for working clearance.
3. Drain oil from transmission by removing drain plug in oil pan.
4. Remove oil pan (clean thoroughly).
5. Check pin "A" (see Fig. 11) using servo gauge J-1127 on rear servo, and if resetting is necessary, mechanic

under car will force pin "A" into rear servo as far as possible by means of servo cam release bar J-1122, see Fig.

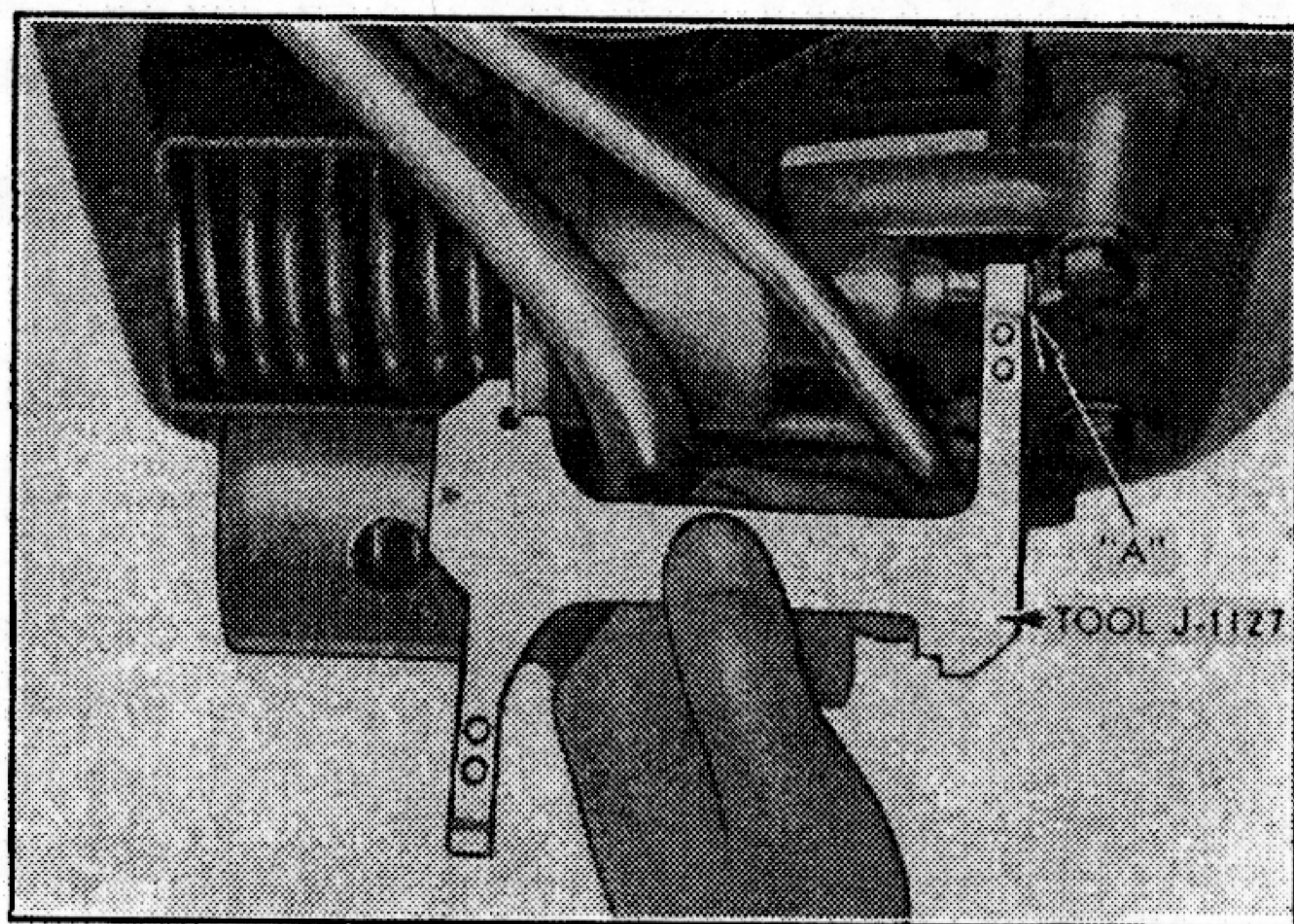


Fig. 11. Checking Servo Band Setting

9. At same time, mechanic inside of car will loosen lock nut "K" and take up all slack in servo bands by turning set screw "J" downward. This will result in pin "A" being too far in servo for correct adjustment. Servo release bar will then be removed and while servo gauge is held in place, mechanic inside of car will back off on adjusting screw until edge of large diameter of pin "A" is flush ($\pm \frac{1}{8}$ ") with outer edge of servo gauge. When setting is correct, tighten lock nut "K."
6. Use same procedure for setting front planetary servo band.
7. Replace oil pan (using new gasket).
8. Lower car.
9. Fill transmission with proper oil to "full" mark on oil level stick.
10. Replace floor center panel.
11. Replace floor mat.
12. Jack up rear wheels in a safe manner and run transmission with shift lever in high range position. This will provide lubrication to all parts of transmission and make possible a check for oil leaks.

Service Information

Clutches slipping or bands dragging may be an indication of trouble in the servo units. Weak springs would cause faulty

operation of the planetary unit involved. Slipping clutches or a dragging of the bands may be caused by an oil leak in servos or oil lines to servos. If leak is not found in external line it would be well to inspect servo pistons for sticking rings, clogged oil lines, etc.

Should it become necessary to replace the actuating lever which is a part of the servo unit assembly, the lever can be removed by withdrawing cotter key from lever shaft and then sliding shaft out.

Throttle Control Lever—Setting

The throttle lever should always be reset if for any reason the transmission is removed and then reinstalled or replaced in a car, or if changes have been made at carburetor that would affect setting of throttle valve or linkage.

Procedure—See Fig. 12

1. Revolve cold idle cam "A" to "hot" position.
2. With throttle adjusting screw "B" set to idle engine at 5 to 6 M.P.H. in 3rd speed, close throttle against cam "A."
3. Disconnect trunnion "D" and move throttle control lever "C" upward until it comes against stop inside transmission. Adjust trunnion "D" until pin will just enter lever "C." Now "lengthen" trunnion "D" two complete turns (this is to allow for slight changes in throttle adjusting screw "B" and a more positive return of throttle lever to idle position).
4. Lock trunnion "D" with nut "E," making sure that detent spring "F" is at right angles to throttle lever "G."
5. Depress accelerator pedal "H" until its stop "L" is against floor mat and observe if detent flat spring "F" over-travels approximately $\frac{1}{8}$ " on trunnion "J." If it does not, clip "K" should be moved "up" the accelerator rod "M" sufficiently to give rod necessary additional travel.

When above settings are correctly made, lever "C" will reach its downward travel

limit when accelerator pedal stop "L" is touching floor mat.

Manual Control Lever—Setting

It is important that manual control lever setting be made each time transmission is removed and reinstalled, or replaced.

Procedure—See Fig. 13

1. Move hand shift lever to "N" (neutral) position.
2. Disconnect transmission lower control lever rod "A" from forward and reverse lever "F" at lower end of hand control shaft.

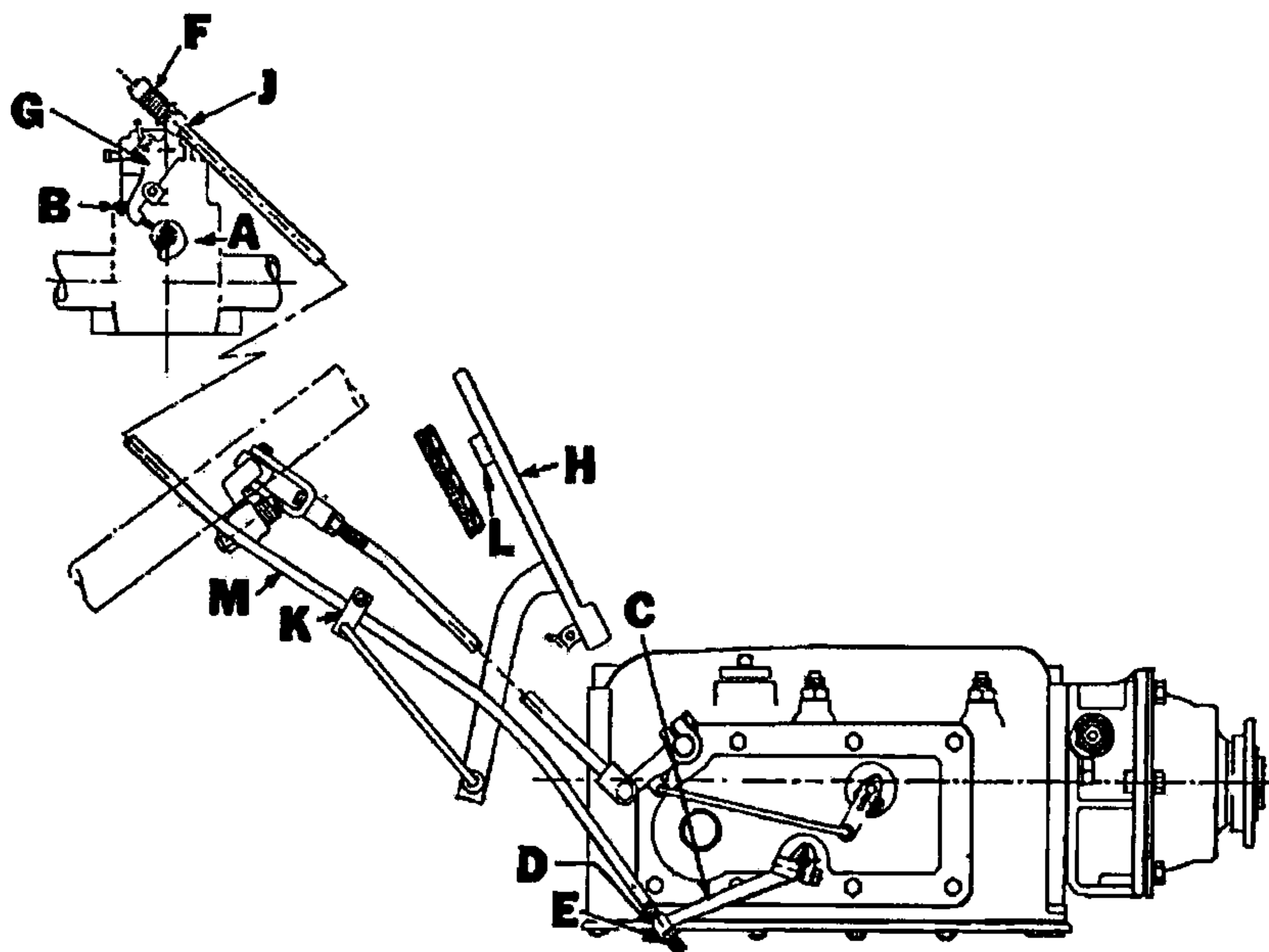


Fig. 12. Throttle Control Linkage

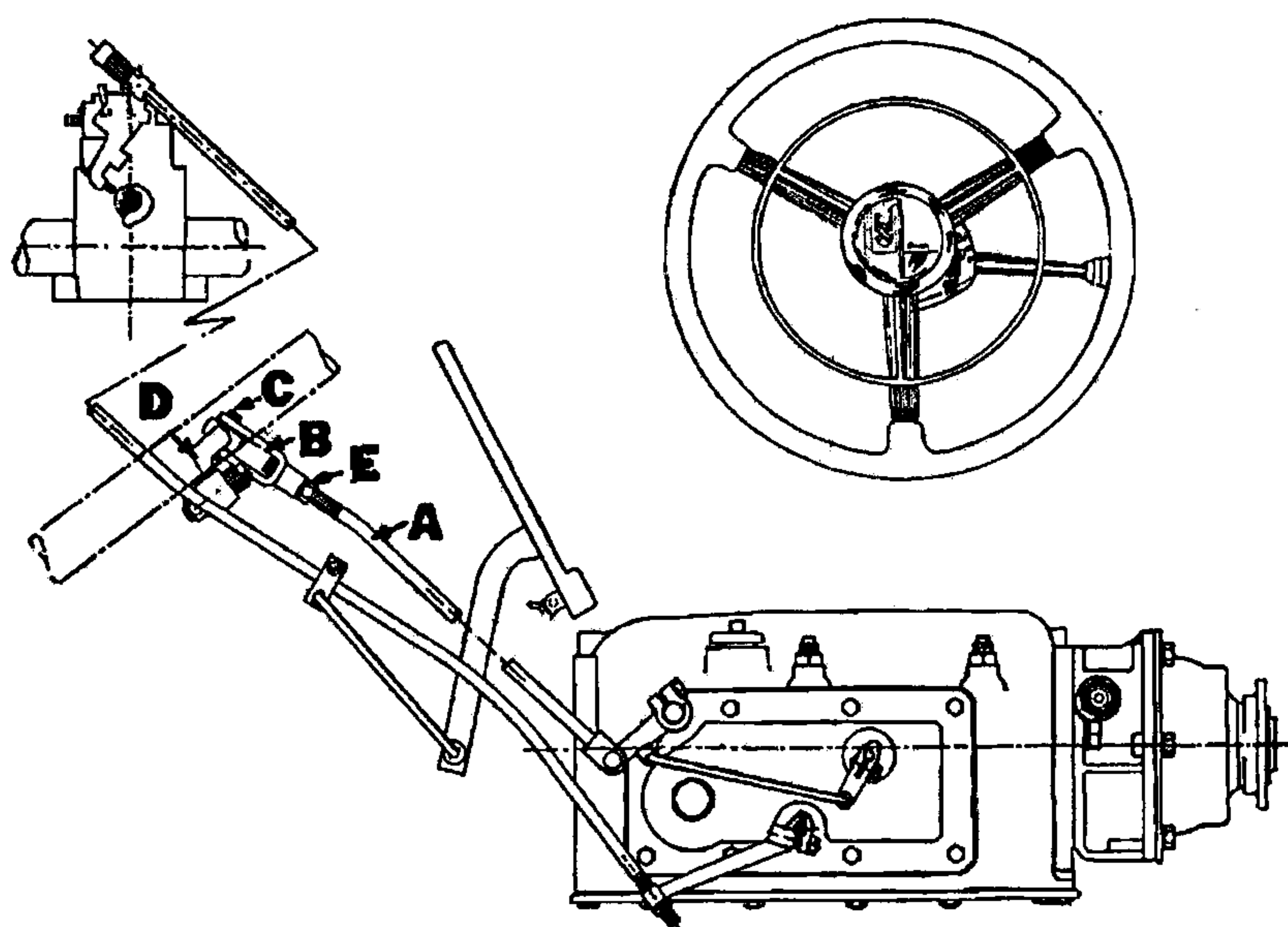


Fig. 13. Manual Control Linkage

3. Make sure forward and reverse shift lever "F" is located in "N" position. This position can be ascertained by pulling control lever rod "A" forward with hand as far as possible and then moving it back until one notch (detent) is felt.
4. Adjust clevis "B" on control lever rod "A" until clevis pin "C" enters freely into hole in lever.
5. Assemble control lever rod "A" to lever "D," using clevis pin and cotter key lock clevis nut "E."
6. Recheck setting of manual control at inside of car to make sure detents in transmission and at shift lever box coincide. To do this, press on button of hand control lever and move lever up and down from "N" position until resistance of detent in the transmission is felt. The points when resistance begins to increase noticeably should be of equal distance above and below the "N" position point on control lever box.

Universal and Ball Joint Assembly

Lubrication

The cap screw which locks front yoke of U-joint to rear transmission main shaft is drilled and tapped to receive an adjusting screw which is drilled to within $\frac{3}{8}$ " (approximately) of its outer end at which point a small radial hole connects it to the surface. This adjusting screw hole connects with the pressure lubrication line drilled through center of the main shaft. In final position, the radial hole connects with a countersunk channel in cap screw. Adjusting screw lock nut closes off this channel except for milled groove across end of cap screw, through which oil is sprayed under pressure to universal joint thus providing lubrication.

An oil return hole in the end plate mates with one drilled through the transmission case. This hole is near the bottom of the end plate assembly.

Removal

1. Remove rear axle. (See 1938 Buick Shop Manual.)

2. Remove torque ball retainers to rear bearing retainer cap screws and then remove torque ball and its inner and outer retainers.
3. Loosen end-play adjusting screw lock nut and back off on adjusting screw approximately two turns. Remove cap screw assembly and its washer and lockwasher, and then remove universal joint.

NOTE: Insert bar in universal joint to prevent it from turning while removing cap screw assembly. The fit between the splines on front yoke and rear transmission main shaft is a light press, but little or no trouble will be experienced in removing joint by hand. Rear bearing retainer should never be removed from transmission case while transmission is still in car. Removal of rear bearing retainer would allow rear of internal planetary assembly to drop to bottom of case, making it very difficult to line up again. There would also be the danger of bell-mouthing reverse counter gear bracket bushing.

4. Press off speedometer drive gear. (This operation is necessary only when drive gear is damaged and must be replaced.)

Installation

Reverse removal procedure. It may become necessary to disconnect speedometer drive cable and remove speedometer driven gear assembly from rear bearing retainer in order to mesh the speedometer gears properly.

END-PLAY ADJUSTMENT—See Fig. 14

After the universal joint has been installed and before assembling torque ball and its retainers, it is necessary to adjust end-play of the transmission. After locking yoke to rear transmission main shaft with the cap screw, tighten adjusting screw as much as possible and then back it off one-third of a turn. Adjusting screw should

then be locked in this position by means of lock nut.

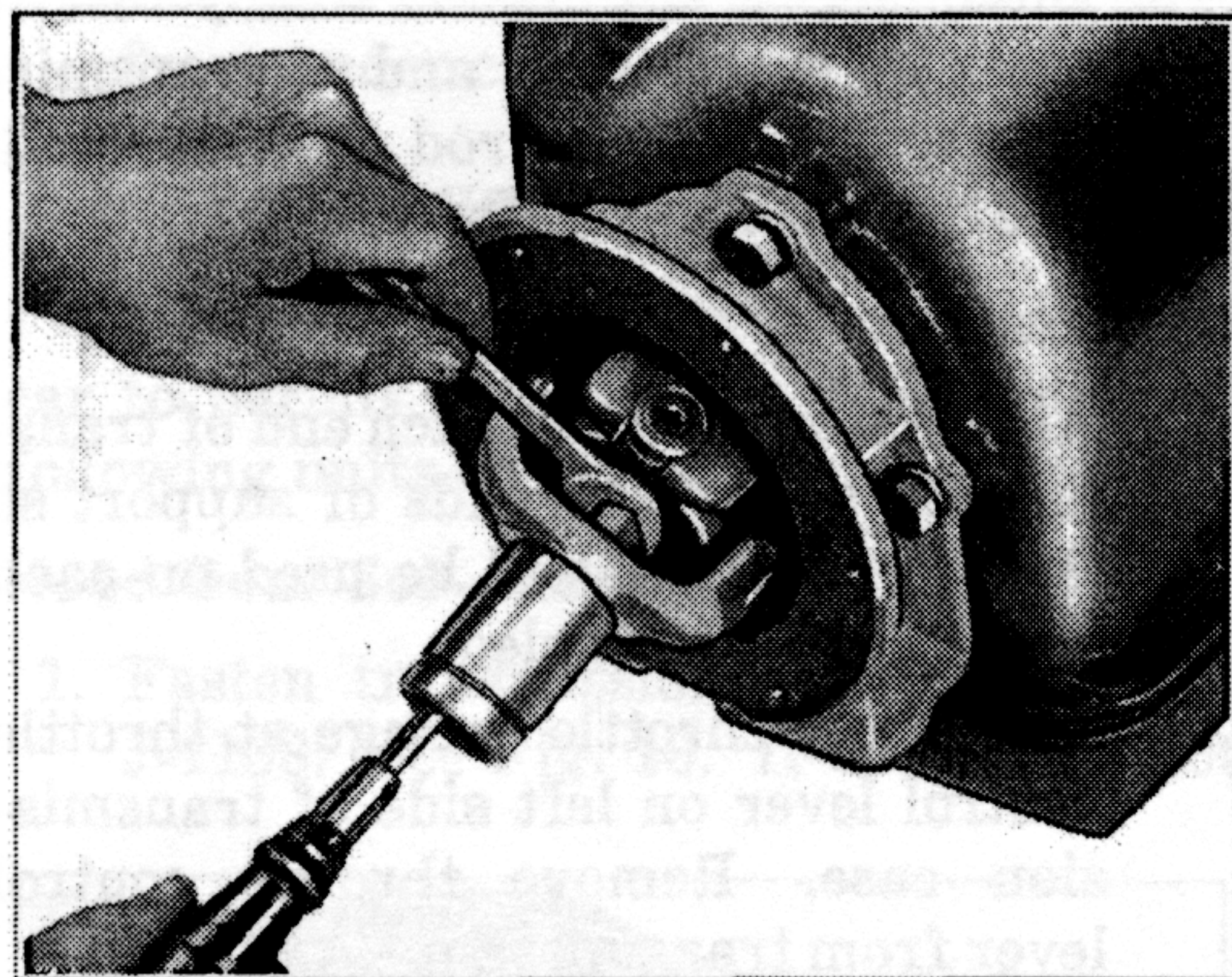


Fig. 14. End-Play Adjustment

Service Information

The most probable reason for service operations on universal and ball joint assembly would be to replace a torque ball either for scoring or faulty bushing (too tight or leaky). The fitting of torque ball and its retainers for Self-Shifting Transmission, which is a special part, is the same as procedure outlined in 1938 Shop Manual.

The thickness of paper torque ball shims are indicated by number or lack of notches in outside edge. The following table identifies notches with their corresponding thicknesses:

3 notches	.004" - .006"
2 notches	.009" - .011"
1 notch	.011" - .013"
0 notch	.013" - .015"

A new 1/2" thick cork oil seal packing, part #1306940, for universal joint outer torque ball retainer, has been released for service. It is used in place of 7/8" thick production seal in case of oil leaks at joint.

Rear Axle Ratios

Approximately (250) 1938 Self-Shifting cars were assembled at the South Gate, California plant with a 3.9:1 (1938-60 Series) axle ratio. The only way to identify such cars is to remove axle housing cover

and inspect gears. In the future, cars will be equipped with the 3.9:1 axle ratio only on special orders.

Speedometer Gears

Cars equipped with standard axle ratio of 3.615:1 use 18-tooth speedometer driven gear (pinion) part #1306764. Cars equipped with mountain type axle ratio of 3.9:1 use 20-tooth speedometer driven gear (pinion) part #1306678. Both driven gears take same drive gear (worm) part #1306766.

Up to serial Nos. 1-3313463, 2-3243493 and 3-_____, cars equipped with 3.615:1 axle ratio have 18-tooth speedometer pinion, part #1299748, and 7-tooth speedometer worm, part #1299595. If for any reason one of these first 3.615:1 axle ratio cars is converted to a 3.9:1 ratio, it will be necessary to install drive gear, part #1306766, to mate with the required 20-tooth driven pinion.

(Above frame number will be supplied in Dealer Bulletin)

PREPARATION OF SERVICE TRANSMISSIONS

Transmissions shipped for service will not have any outside levers (throttle control lever, manual control lever, etc.) Neither will torque ball assembly, universal joint, nor speedometer driven gear assembly be included. A special plate bolted to rear bearing retainer is used to hold internal units in their respective positions by means of the regular cap screw assembly (which includes washer, lockwasher, adjusting screw and lock nut).

In preparing service transmission for use, first remove special plate and then remove from defective transmission parts necessary to complete service transmission. Leave throttle control lever off new transmission until it is installed in car. This prevents possible damage to lever and resulting damage to internal parts if lever is struck or strained during transmission installation. In installing these parts, follow procedures as outlined under section on "Universal and Ball Joint," page 14.

CAUTION

Be sure and make proper end-play adjustment before attaching torque ball assembly. (See End-Play Adjustment, page 14.)

The special end plate will then be bolted to defective transmission, which puts it in condition to ship (oil drained).

IMPORTANT

The shipping crate in which service transmission was received, should not be destroyed, but should be used to return defective transmission.

REMOVAL

Because of the weight of the Self-Shifting Transmission (145 pounds) it is not advisable to risk any failure of hoist by lying under the transmission when transmission is not held in position by at least two bolts.

Procedure

1. Remove rear axle. (See Shop Manual.)
2. Push front seat assembly back as far as possible and cover front seat cushion.
3. Remove floor mat (it is not necessary to remove accelerator pedal).
4. Remove center floor panel.
5. Drain oil from pan by removing drain plug. Replace plug and remove pan. **After pan has been thoroughly cleaned, (to prevent sediment or dirt of any sort which has collected in bottom of pan from being distributed through transmission parts when it is turned over upon removal) replace pan and secure it with three or four cap screws.**
6. Disconnect speedometer cable at transmission.
7. Remove two upper transmission to flywheel housing attaching bolts, and install two special guides, J-1126.

NOTE: It is desirable at this time to have front of car slightly higher than rear to assist in sliding transmission backward.

8. Remove flywheel housing pan.
9. Remove clutch release yoke.
10. Disconnect transmission steady rest at outer or frame ends and at transmission and also brace rod at frame end. Remove steady rest assembly.

IMPORTANT

Attach shims used at each end of transmission support to ends of support so that same shims will be used on each side when reassembled.

11. Disconnect throttle linkage at throttle control lever on left side of transmission case. Remove throttle control lever from transmission.
12. Disconnect manual shift rod at clevis connection.
13. Place transmission lifting tool, J-1129, in front compartment over floor opening. See Fig. 15.

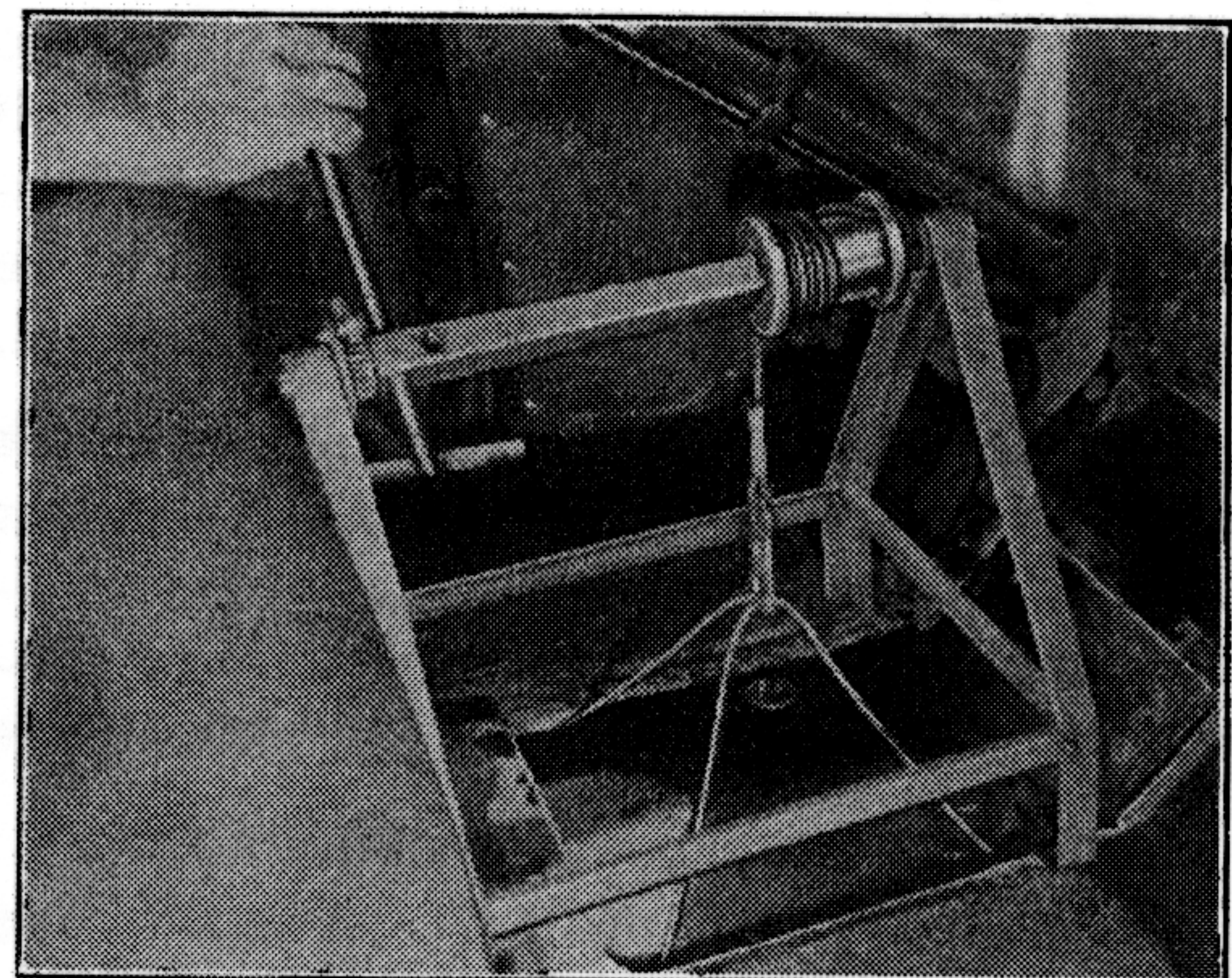


Fig. 15. Transmission Removal

14. Place cradle of lifting tool under transmission and fasten cables to hoist hook. Right cable should be over and in front of oil pump and left cable should be over and in front of forward and reverse shifter shaft.
15. Raise cradle just enough to support transmission when remaining bolts are removed. **Be certain that hoist is locked.**
16. Remove both lower transmission to flywheel housing bolts.

17. Slide transmission toward rear and at same time work clutch release bearing retainer out with transmission.
18. Lower transmission to floor and slide from under car.

UNITS SERVICED AFTER REMOVAL

The transmission must be removed from car to permit servicing or disassembly of following units or parts.

Head Gear Set—Removal

1. Fasten transmission on support, tool J-1138. See Fig. 16. If support is not

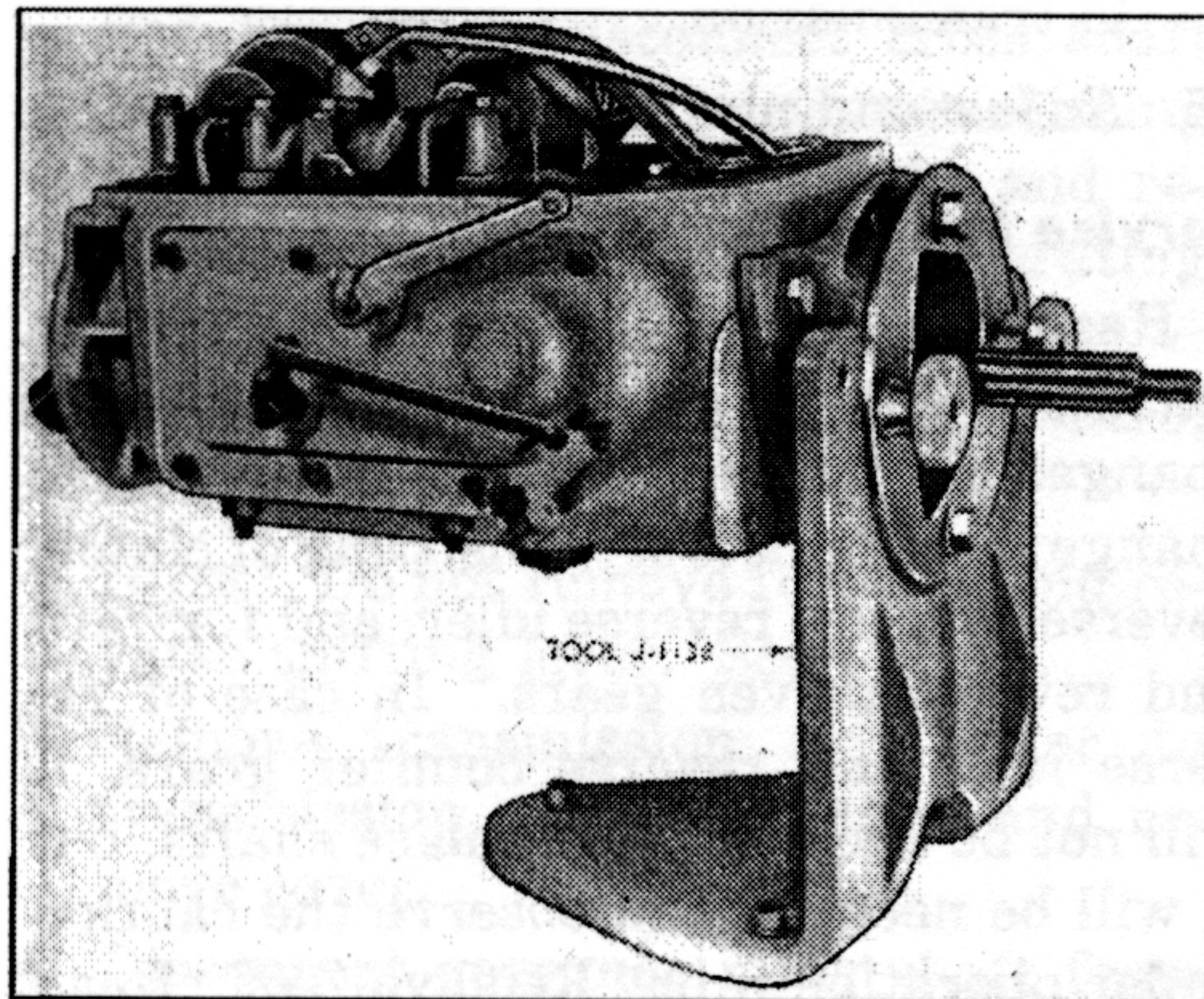


Fig. 16. Holding Stand in Use

available, work can be done on any work bench.

2. Remove oil pan.

NOTE: There are four tapped holes which lead directly into transmission case. Studs are used at these points to prevent oil leakage. When replacing studs for any reason, use same length studs dipped in white lead.

3. Remove oil pressure line (oil pump to front servo).
4. Remove reverse idler and counter gear shaft lock screws. See Fig. 8.
5. To remove shafts, place a screwdriver in slot at front end of shaft, turn shaft and at same time apply pressure to rear end of shaft with finger or some small tool. If shafts cannot be removed as explained above, it will be necessary to

remove both servos (see Servo Removal, page 10). With servos removed, shafts can be driven out, using a punch and hammer.

NOTE: Be careful not to damage bushings when driving out shafts, also not to drop bronze thrust washer located between rear end of counter gear and center support bracket. **Counter gear and reverse idler gear shafts are identical; however, they should be marked for identification and not interchanged because of selected fits in case.**

6. Remove reverse idler gear and counter gear.
7. When removing clutch gear, the end-play adjusting screw should first be released as outlined on page 14 under "Universal and Ball Joint—Removal." Remove clutch gear, bearing and retainer as an assembly. This assembly is held by a snap ring in outer diameter. Ring must be expanded by a wedge-shaped tool, J-1124, inserted in case recess, which will spread ring (into groove in case) permitting clutch gear to be pulled out. See Fig. 17.

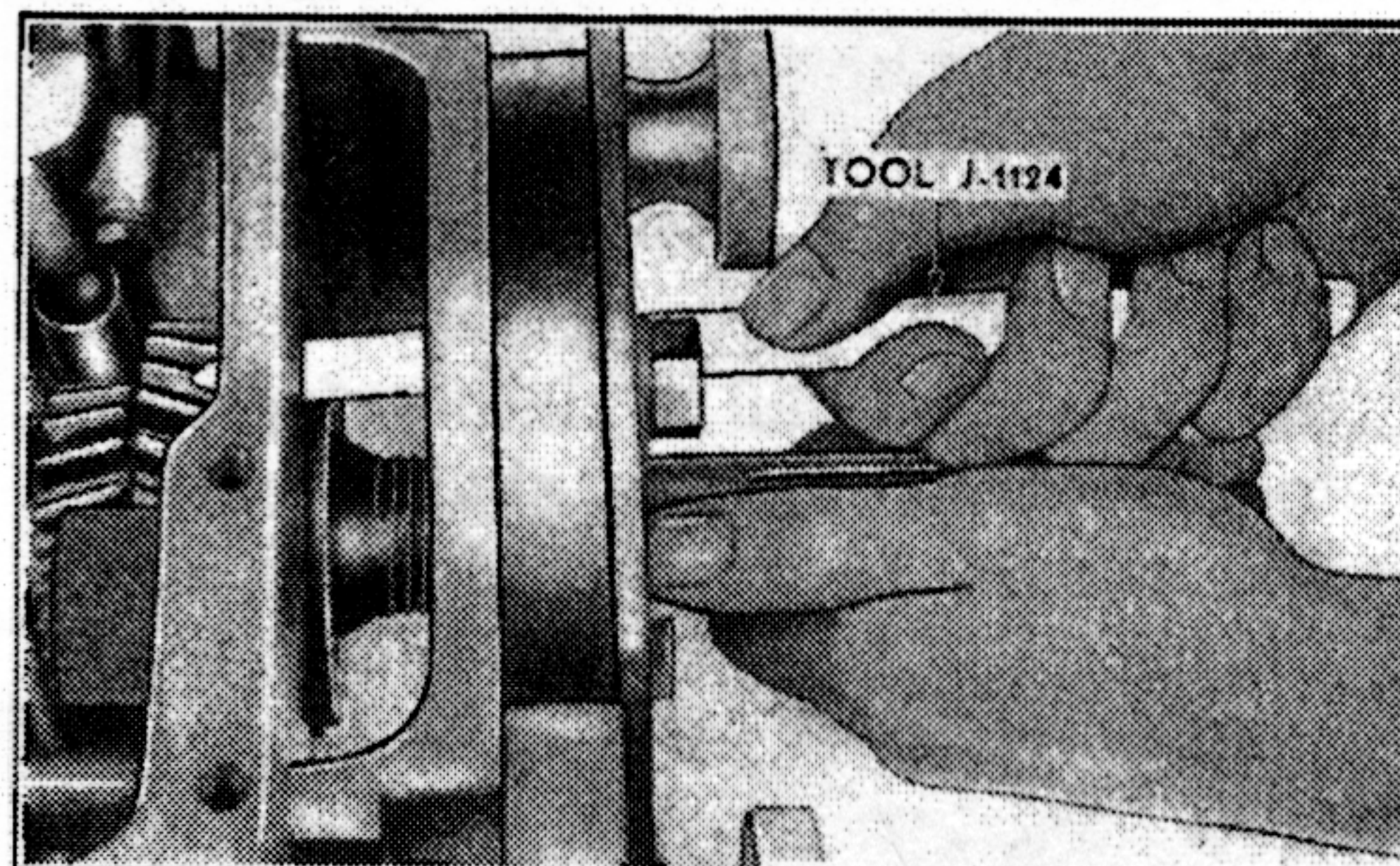


Fig. 17. Clutch Gear Removal

NOTE: A thrust bearing consisting of two thrust races and three balls is located in gear end of assembly, see Fig. 36, and will come apart if spline end of gear is not tilted down as far as possible when withdrawing clutch gear assembly. When necessary, it is expedient to remove clutch gear bearing from gear shank by "shocking" it off, i.e., strik-

ing pilot end of gear on lead, hardwood or solder block. The limits on fit between inner race and gear shank is from .0001" loose to .0005" tight which should offer no difficulty to this method of bearing removal.

8. Remove shifter fork rail lock screw and rail. There is a poppet spring and locating ball in shifter fork. When rail is removed, spring will stay in place but ball will drop out into transmission. **Be sure to locate and remove ball.** Use tool HMO-65-6 to remove ball.
9. Remove shifter fork. Let fork drop to clear it of groove in forward and reverse driven gear and then work it up out of case by moving it forward and toward governor side.
10. Remove forward and reverse driven gear from shaft of front unit driving gear.

Installation

1. Replace forward and reverse driven gear on shaft of front unit driving gear. (Shifter fork groove should be toward rear of transmission.)
2. Install shifter fork and rail. Before installing fork it will be necessary to assemble poppet spring and ball in fork. It will be necessary to use tool J-1147 for this operation. This is a short, pointed piece of stock used for holding detent ball in place in fork. The tool is forced out when shaft is entered and should be recovered from case. **Care should be taken to install shaft so that notches line up with detent ball.** Rotate inner end of shifter shaft toward reverse counter gear bracket while installing shifter fork shaft.
3. Install clutch gear assembly, using tool J-1124.

NOTE: A small amount of lubricant will keep ball thrust bearing assembly in place during clutch gear installation. When installing a new clutch gear bearing or bearing spacer, it is necessary to select the correct ring (front clutch bearing snap ring) which allows mini-

mum end-play of spacer. This ring is furnished in four different thicknesses each of which is marked with an identifying color on circumference according to following table:

Part No.	Color	Thickness
1304060	White	.063"
1304061	Yellow	.067"
1304062	Green	.071"
1304063	Red	.058"

4. Reverse removal procedure for remaining installation operations.

NOTE: Pointed side of teeth on idler gear should be assembled toward front of transmission.

5. Adjust end-play as outlined on page 14.

Service Information

Head gears are released for service as matched sets so that when gears are changed for noise it will be necessary to change the complete set consisting of clutch, reverse counter, reverse idler, and forward and reverse driven gears. In case of reverse idler and reverse counter gears, it will not be necessary to replace shafts, but it will be necessary to observe the caution under operation 5 in "Removal" of "Head Gear Set." Matched head gear sets are not necessary when single drive oil pump is used.

The balls in thrust bearing assembly are not a select fit but are interchangeable. Pro-

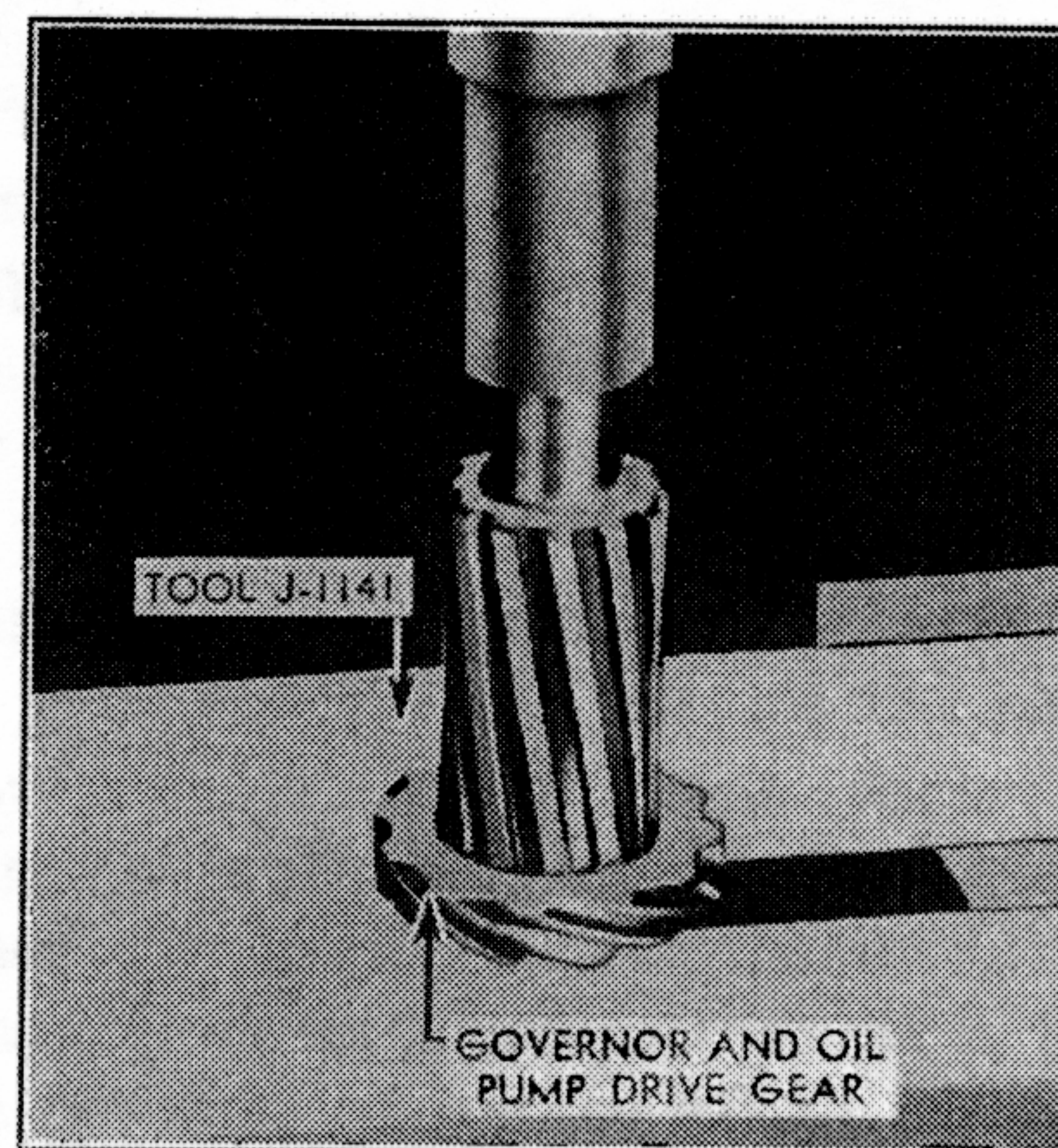


Fig. 18. Oil Pump Drive Gear Removal

duction limits make it possible to replace any or all of the balls separately and also either or both thrust races. **Use only balls purchased as transmission parts.**

The bronze oil pump drive gear, located on reverse counter gear, can be serviced separately. This gear should be replaced if it is damaged in any way, worn or loose on its shaft. The gear must be removed from shaft, or replaced, by means of an arbor press and tool J-1141, see Fig. 18.

Governor—Removal

1. Loosen clamp bolt in rear unit cam operating lever and pry lever off shaft. See Fig. 20. Disconnect cross shaft from forward and reverse shifting lever by removing cotter pin and remove cross shaft with cam operating lever.

2. Loosen clamp bolt in throttle control lever and pry lever off shaft.

NOTE: Do not remove forward and reverse shifting lever. See Fig. 21.

3. Remove transmission side cover to transmission case cap screws and remove cover.

4. Disconnect governor relay shaft from governor assembly by pulling out upper governor relay shaft pivot. This pivot and also the lower one are locked in case by two of the side plate to case screws. See Fig. 21.

Move governor relay shaft towards rear of transmission, which provides enough space to remove the governor.

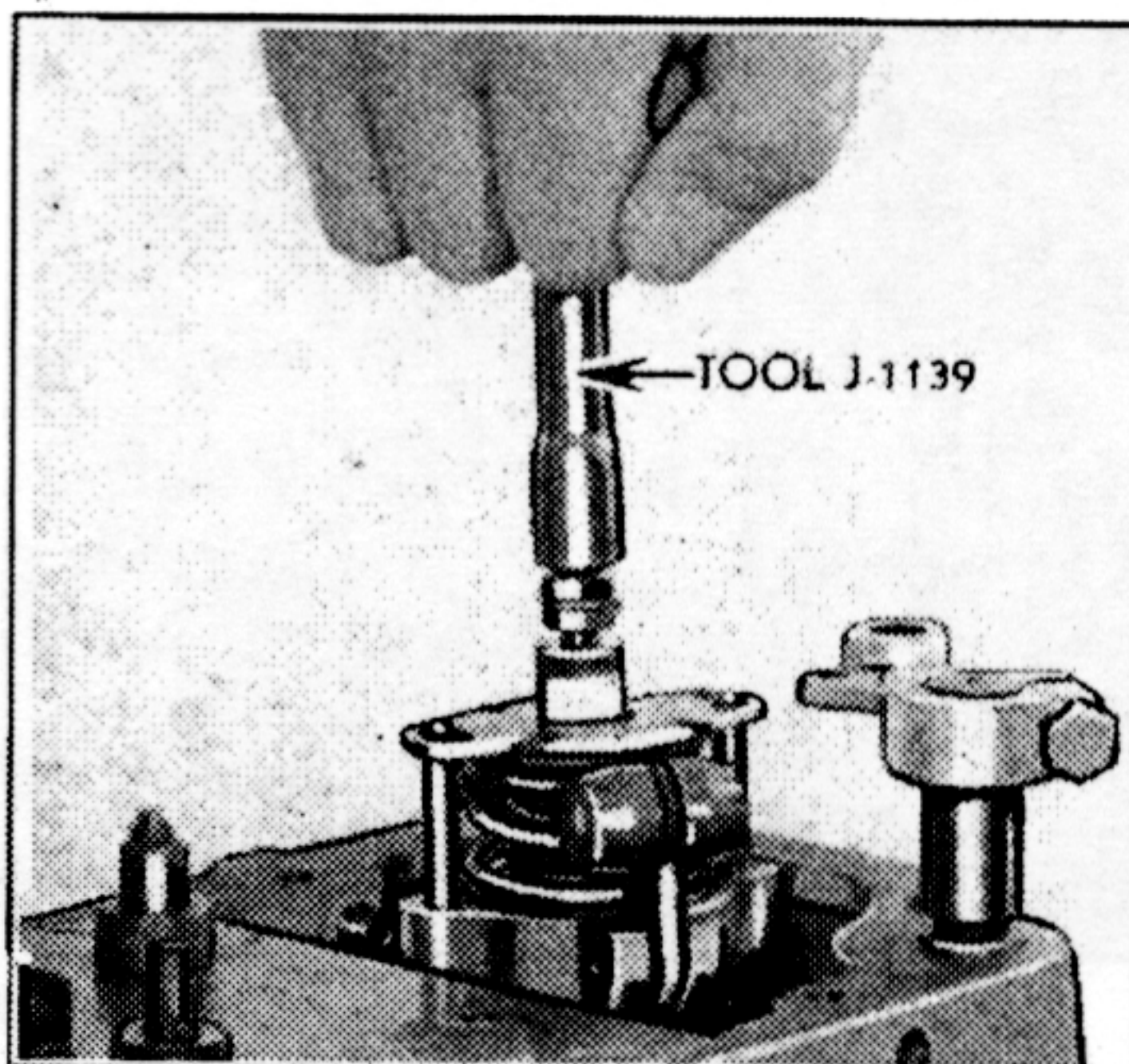


Fig. 19. Governor Removal

5. Remove governor to case attaching screws, and remove governor. (Tool J-1139 will come in handy at this point.) See Fig. 19.

NOTE: When removing and installing attaching screws, it will be convenient to use tool HMO-65-6. Dropping screws may necessitate the removal of oil pan. If governor fly ball weights prevent access to screws, insert clutch gear spline or flat piece of metal in spline of universal joint and rotate transmission planetary units until weights clear screws.

Installation

Reverse removal sequence.

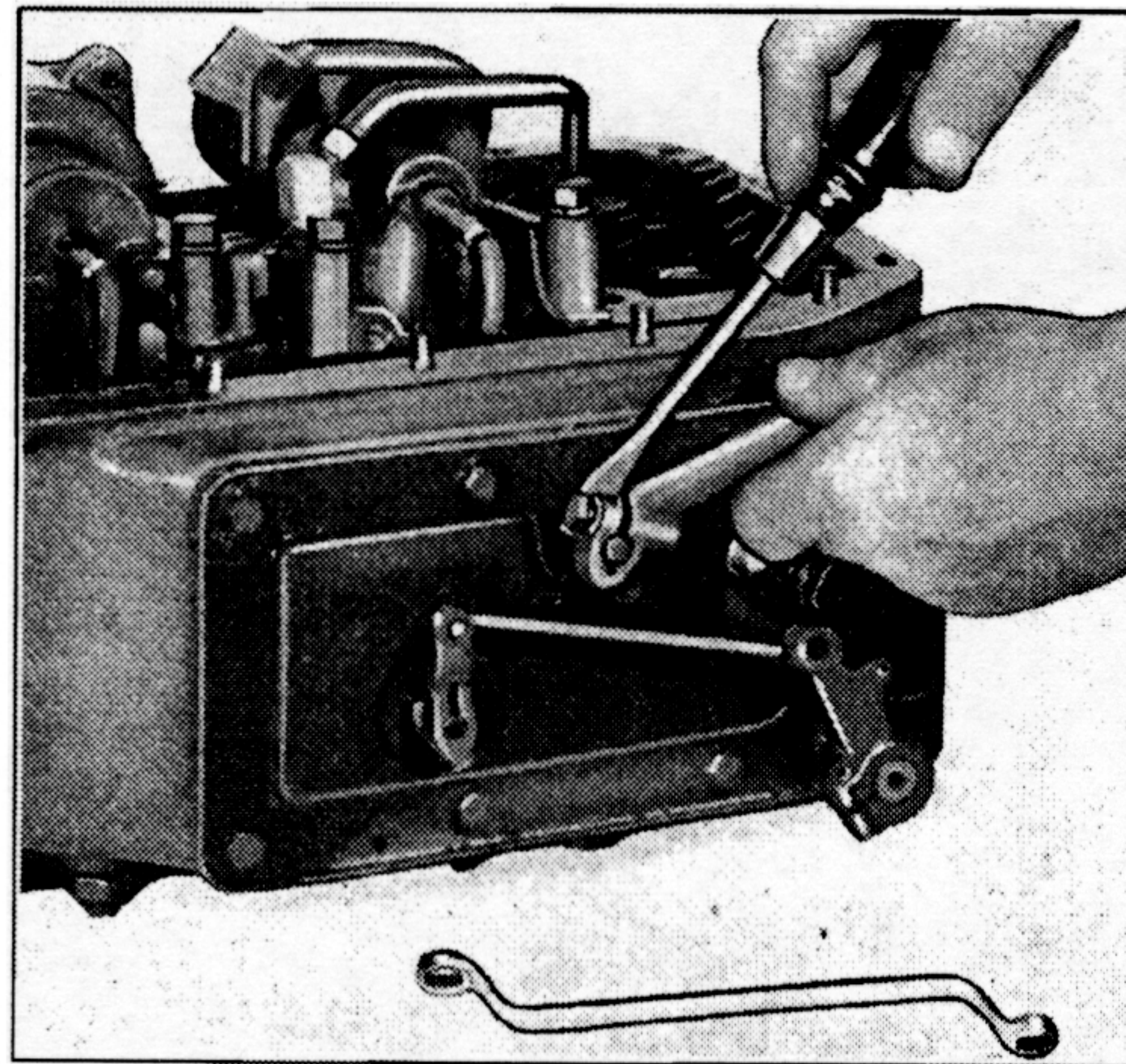


Fig. 20. External Lever Removal

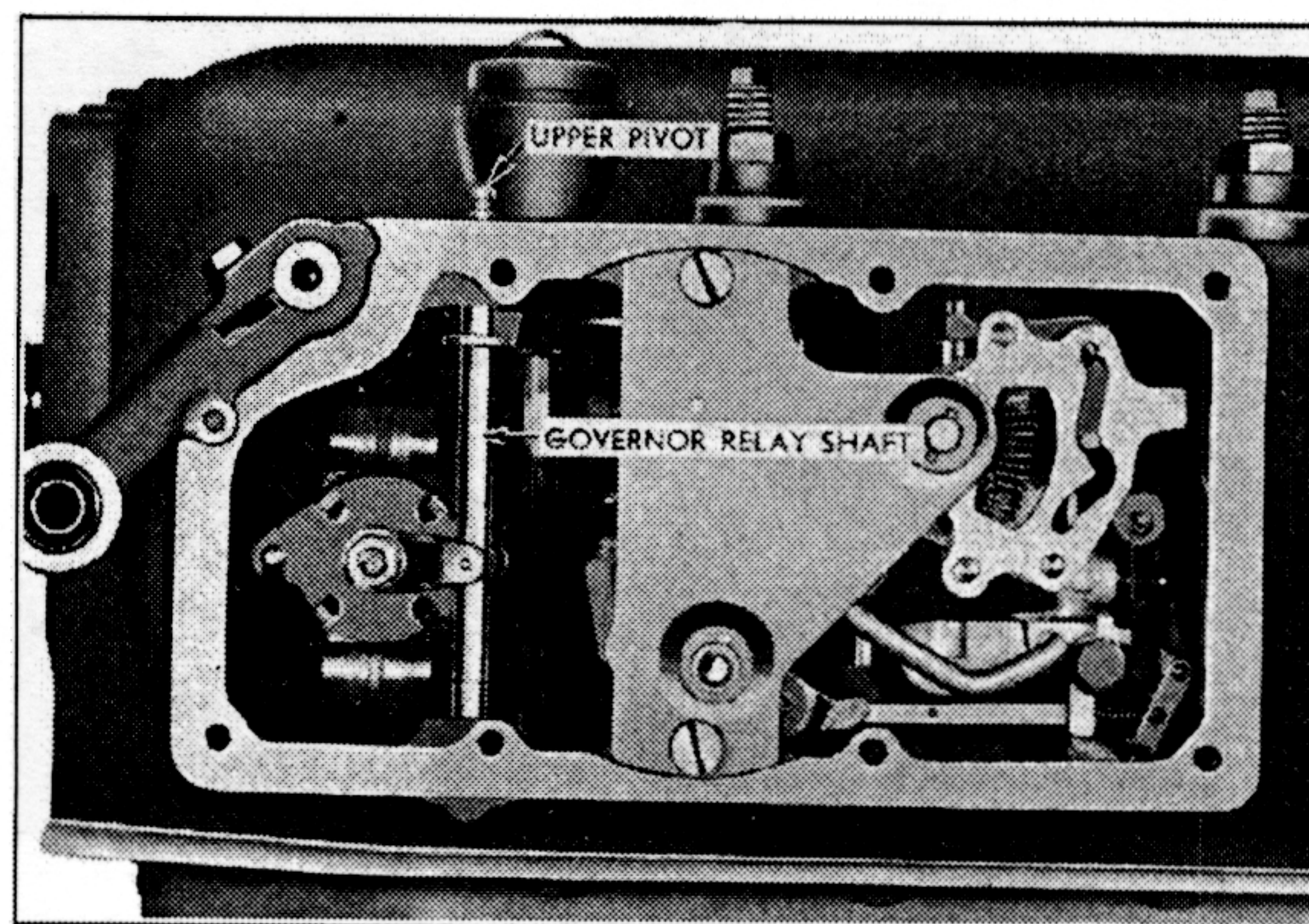


Fig. 21. Governor Relay Shaft and Pivot

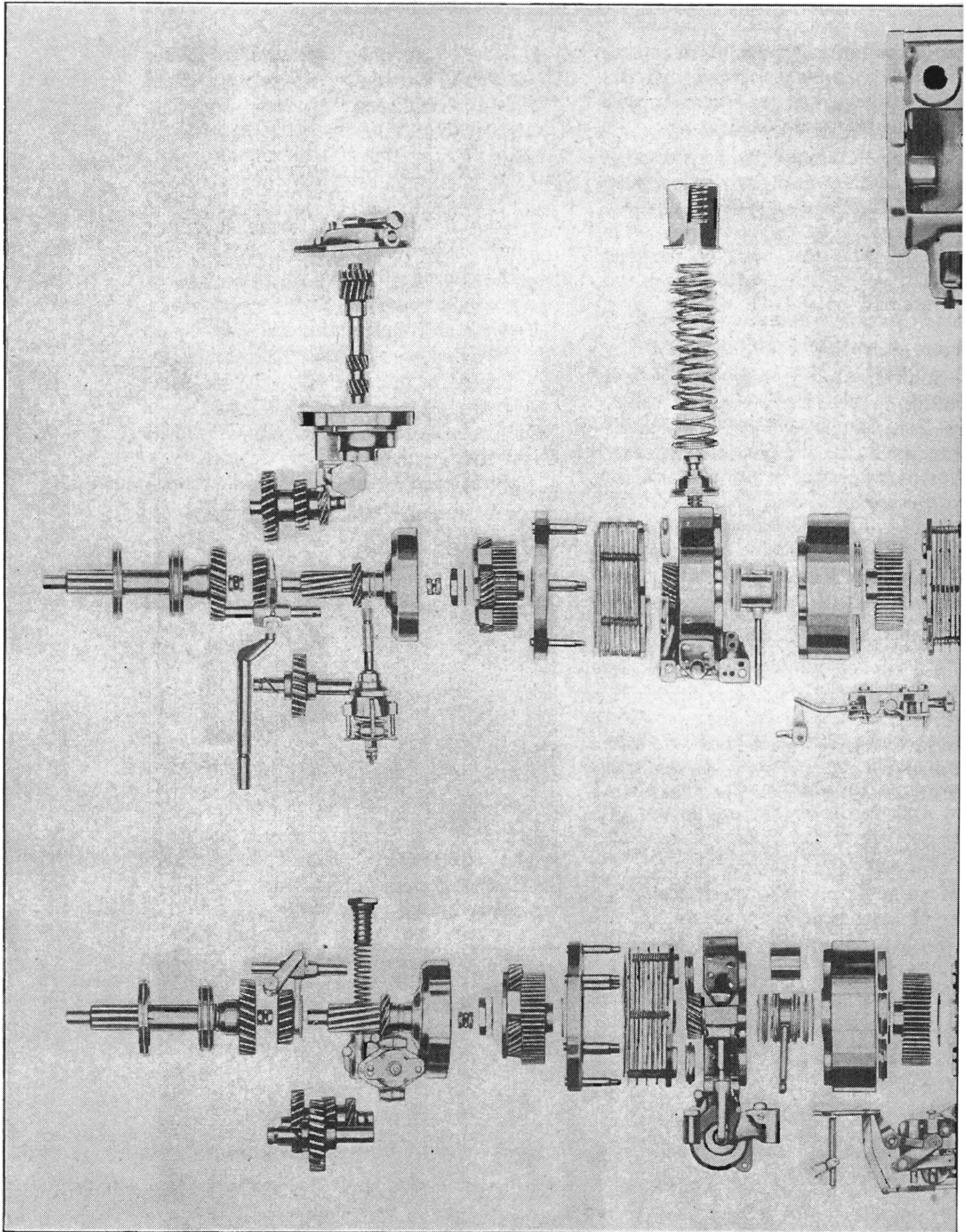
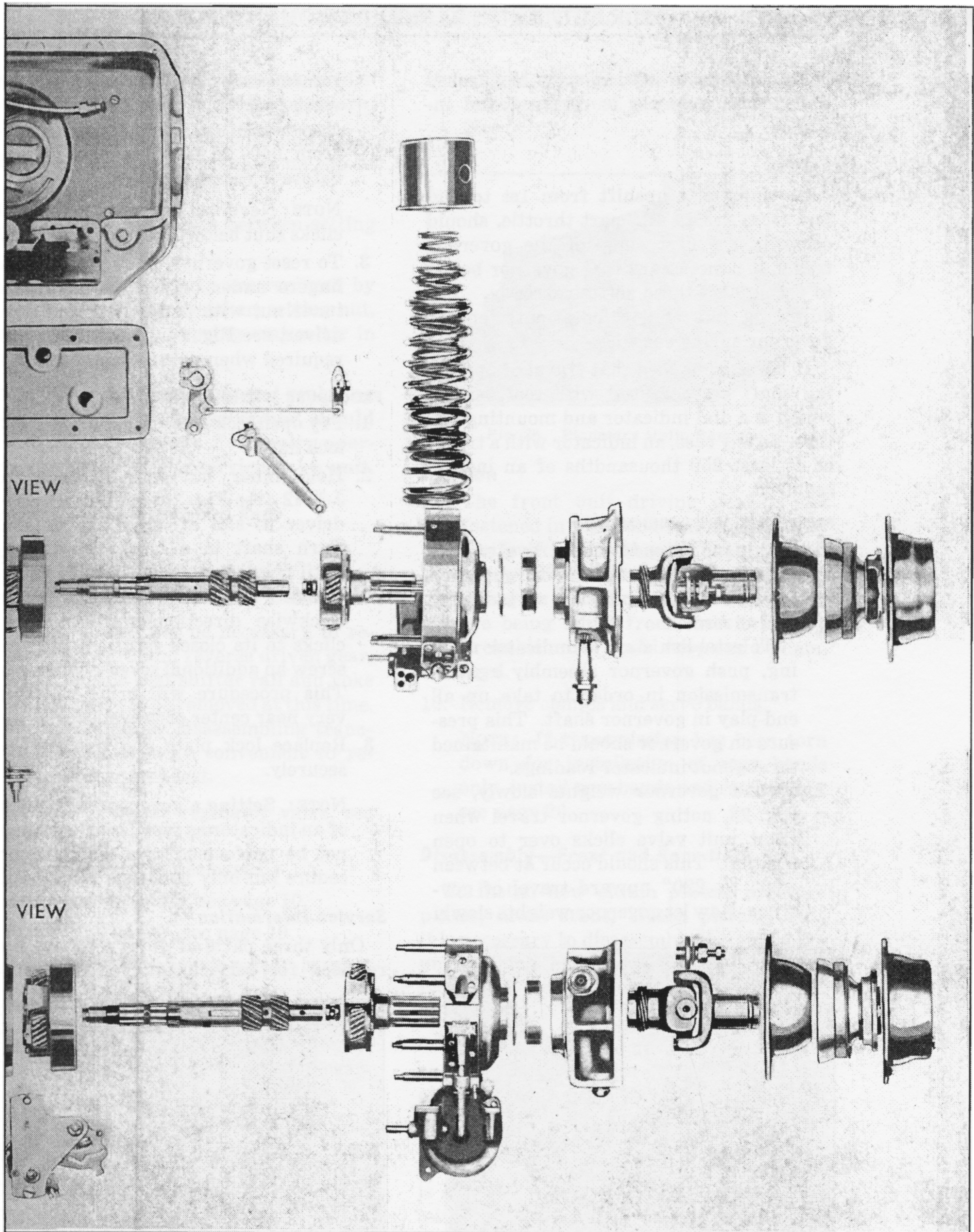


FIG. 22. SELF-SHIFTING



SECTION—EXPLODED VIEW

NOTE: Governor setting must be checked every time governor is removed and installed.

Setting

As automatic upshift from 1st to 2nd and from 3rd to 4th, part throttle, should occur in the first stage of the governor travel, it is necessary that governor be set to accomplish these shifts correctly. The adjusting nuts are located at outer end of governor spring seat.

It is recommended that travel of operating shaft be measured with tool J-1146, which is a dial indicator and mounting fixture. In any case, an indicator with a travel of at least 250 thousandths of an inch is required.

PROCEDURE WITH INDICATOR

1. Set up indicator to check travel of governor. See Fig. 23. With governor weights in closed position, set indicator dial at zero.

To establish start of indicator reading, push governor assembly against transmission in order to take up all end-play in governor shaft. This pressure on governor should be maintained throughout indicator readings.

2. Spread governor weights slowly, see Fig. 23, noting governor travel when front unit valve clicks over to open position. This should occur at between .200" to .220" upward travel of governor. Now let governor weights slowly

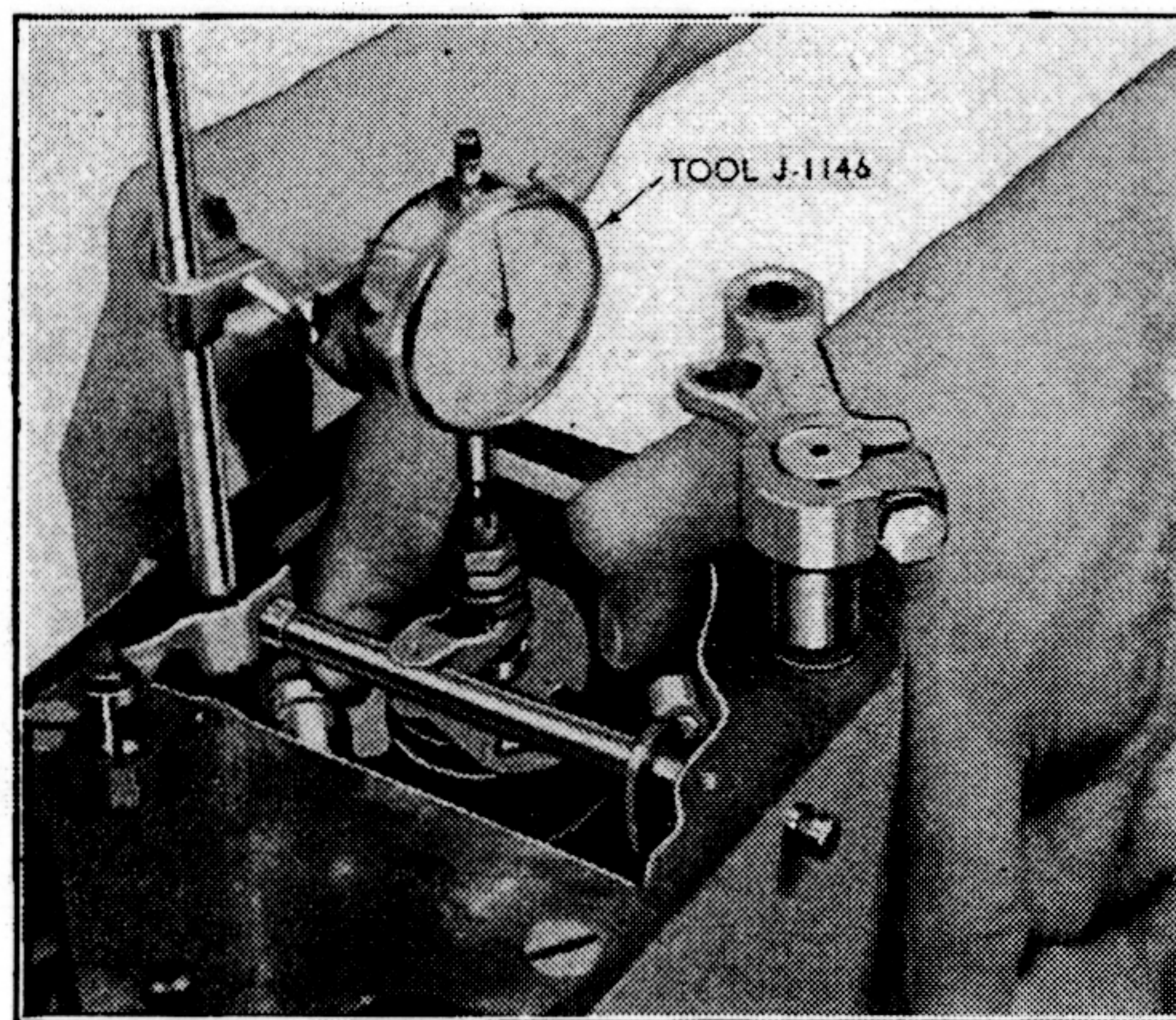


Fig. 23. Checking Governor Setting

return and note travel of governor when front unit valve clicks back to its closed position. This should occur at from .040" to .030" travel of governor before it reaches its seat.

NOTE: Never set governor so that valve clicks shut below .030" governor travel.

3. To reset governor, pry open lock plate fingers under outer lock nut and set inner nut with tool J-1142 and screwdriver, see Fig. 24. New lock plate is required when governor is reset.

PROCEDURE WITHOUT INDICATOR

1. Pry open lock plate fingers under outer lock nut.
2. Hold inner nut with wrench, tool J-1142 (see Fig. 24) and insert screwdriver in slot at outer end of shaft. Turn shaft in a clockwise direction until front unit valve clicks to its open position. Then turn shaft in a counter-clockwise direction until valve *just* clicks to its closed position, then turn screw an additional seven-eighths turn. This procedure will bring the shifts very near center of travel.
3. Replace lock plate and nut and lock securely.

NOTE: Setting a governor without use of an indicator as just described, should not be performed as a standard procedure but only as a case of necessity.

Service Information

Only three parts of governor have been released for service and replacement of

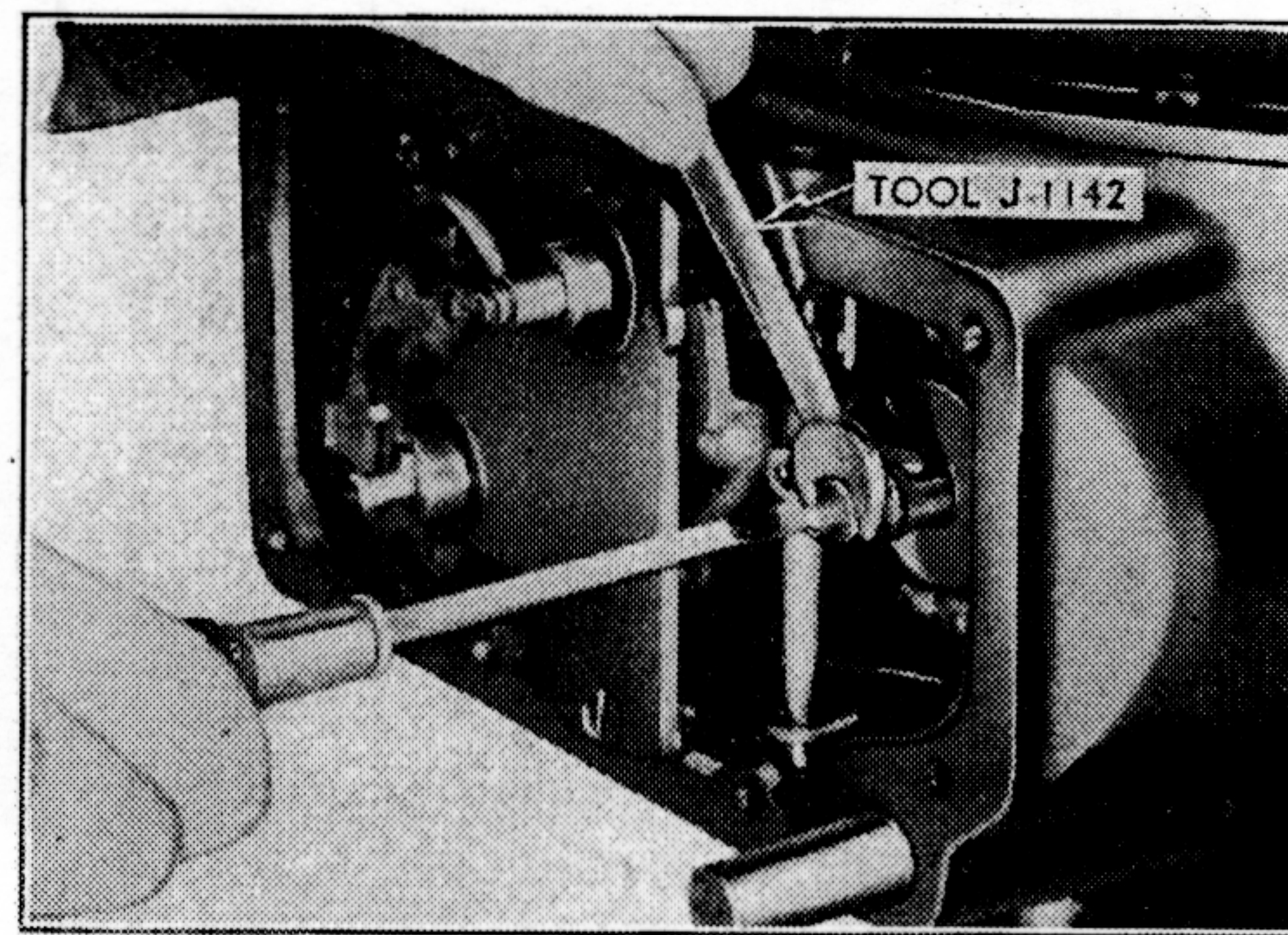


Fig. 24. Resetting Governor

these parts does not involve a major disassembly of governor. The three parts are:

Spring seat collar (part with flat sides)
Retaining washer (assembles on top of collar)

Lockwasher (assembles between setting and lock nuts)

Any or all of these parts are replaced by removing lock nut, lockwasher, setting nut, retaining washer and spring seat collar in that order.

NOTE: Other than removing and replacing above mentioned parts, **governor should never be disassembled. For faulty operation, governor will be serviced as a unit.**

Planetary Units—Front and Rear

Removal

1. Remove head gear set. See page 17.

NOTE: It will not be necessary to remove forward and reverse driven gear, which means that shifter rail and yoke will not have to be removed at this time. When completely disassembling transmission, it is more convenient to remove shifter fork last.

2. Remove pressure regulator valve, see page 6.
3. Remove oil pump, see page 6.
4. Remove servo units, see page 10.
5. Remove governor, see page 19.
6. Remove reverse counter gear bracket (center bearing cap).
7. Remove universal joint and torque ball assembly, see page 14. In addition, it will be necessary to remove rear bearing retainer or end plate.
8. Rotate servo bands with ends toward bottom of transmission and clamp ends with a modified brake clamp, tool J-1173. See Fig. 25.

9. Lift both planetary units from case together. It will prove very convenient to use tool J-1148 as a handle for lifting unit at its approximate center of

weight, making sure that front shaft is not pulled out of position. See Fig. 25.

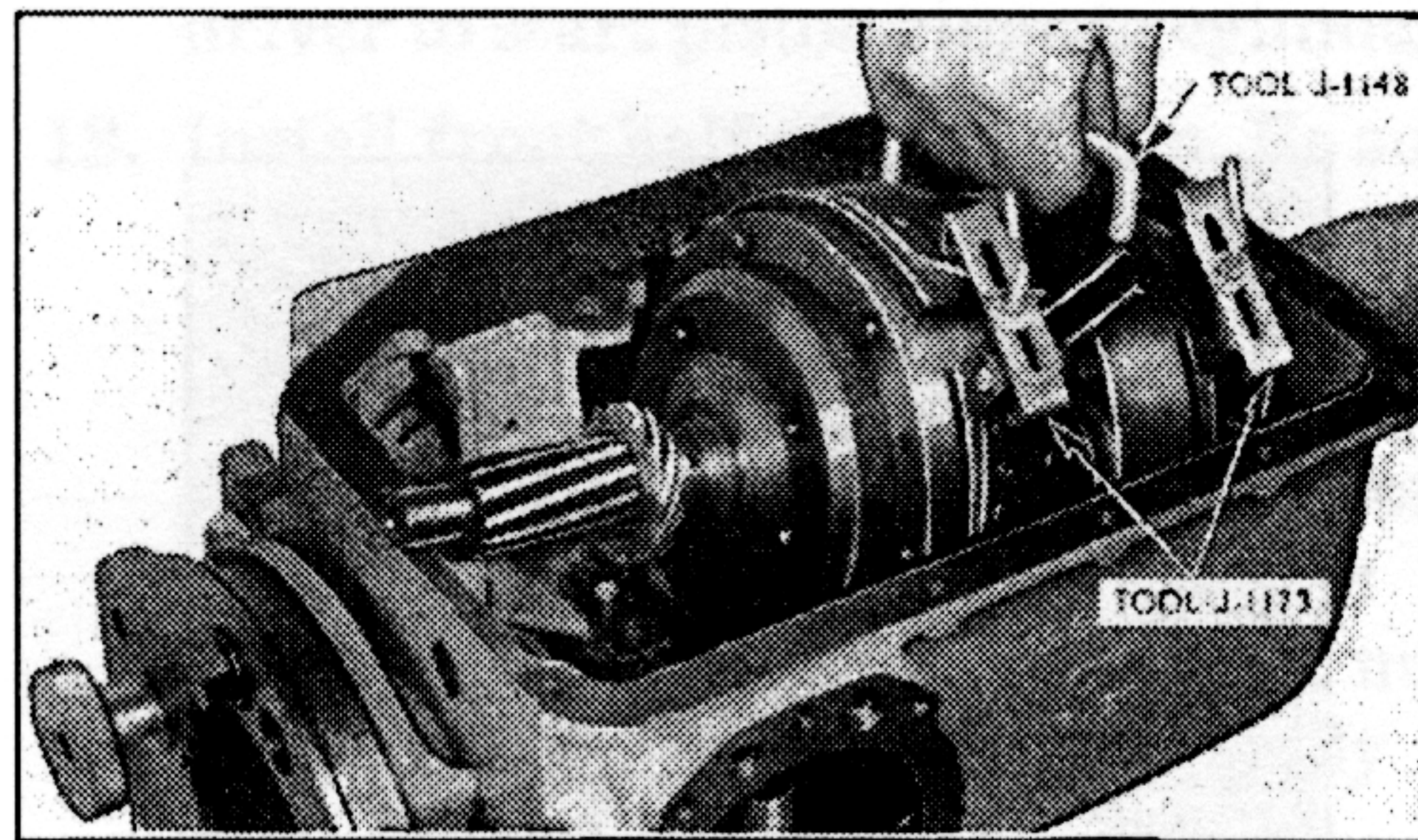


Fig. 25. Planetary Units Removal

CAUTION

The front unit driving gear is not fastened in place and will slide off very easily if any lifting is done (except when it is in a horizontal position). If this gear should slide off while units are being lifted from case it is very probable units would drop and be damaged.

10. Remove clamps and servo bands.

NOTE: If transmission has been torn down for installation of new bands only, install new bands and reassemble, see page 26.

Disassembly—Front and Rear Unit

To install new **clutch plates, pressure plates, drum studs, clutch pistons, etc.**, it is necessary to disassemble the planetary units which have already been removed from case. See "Planetary Units—Removal."

Owing to large number of small parts such as thrust washers, thrust bearings, etc., that are removed in the following disassembly, it is essential that proper location of each be noted. Each part has a certain job to perform, hence, proper location is essential for proper operation of transmission.

PROCEDURE

1. Remove front unit driving gear. Prevent ball thrust from falling out.

2. Place unit assembly in a vise and clamp transmission driven shaft firmly, using copper or brass jaws to prevent damage to shaft. See Fig. 26.

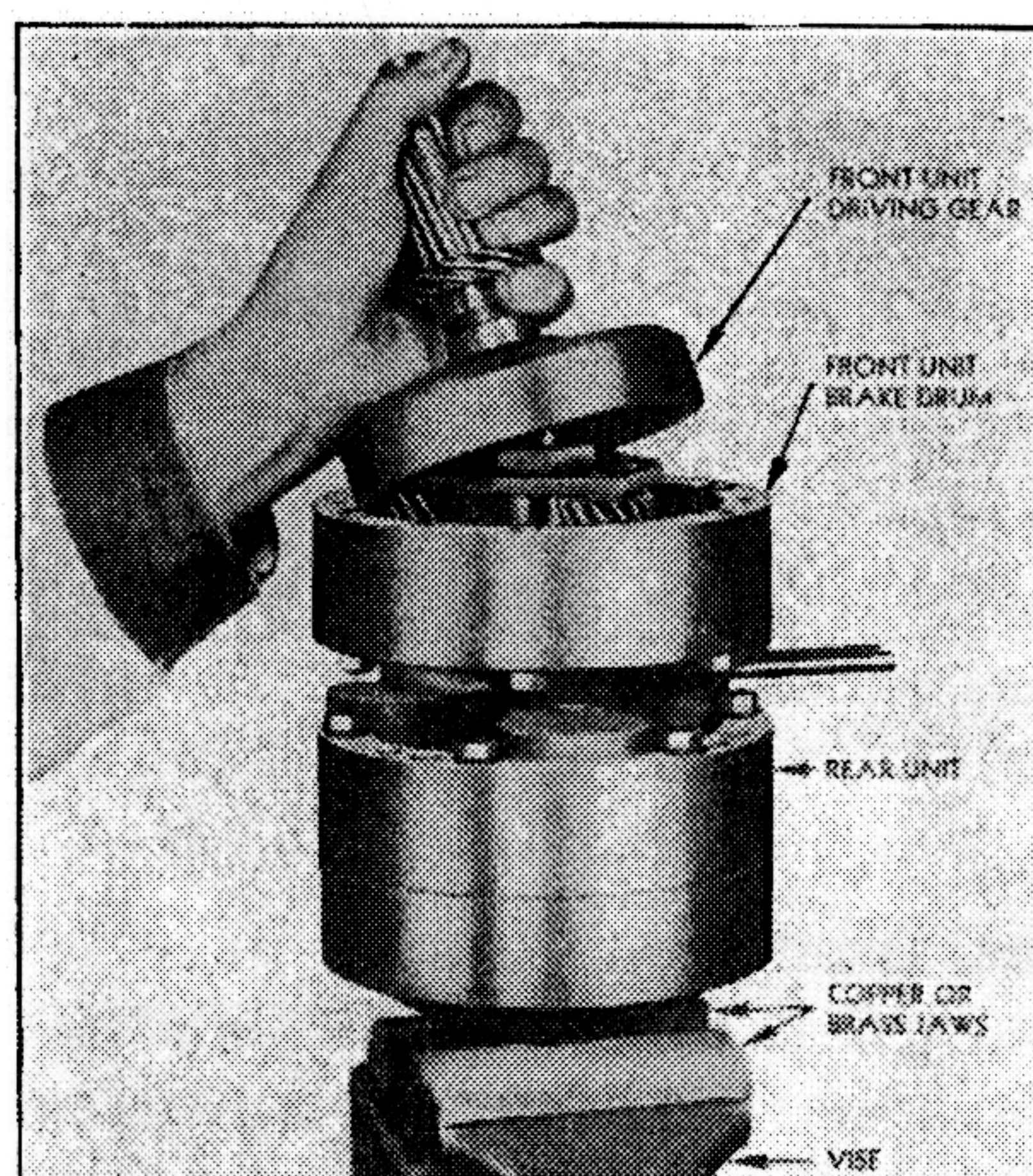


Fig. 26. Holding Units for Disassembly

3. Loosen main shaft nut, using standard hex. box end wrench and front planetary carrier holding wrench, tool J-1121.

NOTE: Tool S-9598, Knee-Action Box-socket Wrench, can be used for loosening and tightening main shaft nut.

4. Remove front unit by lifting it off main shaft.

NOTE: Do not turn front unit over or clutch hub will fall out.

5. Remove oil delivery sleeve and spacer.

Disassembly—Rear Unit

1. Loosen and remove hex. nuts holding rear unit drums together.
2. Remove front half of drum, making sure pressure plate is free.

NOTE: Planetary units are balanced as assemblies in production, therefore, the two halves of the drum assembly, both front and rear, should be marked before disassembly so that they can be re-assembled in the same relationship to each other.

3. Remove oil seal ring and thrust washer from center of front half of drum.
4. Remove clutch pistons (3) from front half of drum. These can be removed by pliers in countersunk holes.
5. Remove pressure plate.
6. Remove clutch release springs.
7. Remove bronze and steel clutch plates. (Seven steel driven plates and eight bronze drive plates.)

NOTE: Care should be taken when removing clutch plates so that they can be reinstalled in original order in transmission.

8. Remove clutch hub. This hub is keyed to main shaft and has a bronze thrust washer assembled on each side.
9. Remove remaining assembly from vise.
10. Bump universal joint end on wooden or lead block. This will remove rear half of rear unit drum.
11. Planetary gears and main shaft will now come apart.

NOTE: A ball thrust bearing assembly is located at rear end of main shaft. Do not lose balls or thrust races.

Disassembly—Front Unit

1. Remove front unit clutch hub and pinion carrier assembly which can be lifted out with the fingers.

NOTE: A bronze thrust washer is located between center gear and pinion carrier assembly.

2. Remove hex. nuts holding drum and flange together.
3. Remove drum. See operation 2, "Disassembly—Rear Unit."
4. Remove oil seal ring and thrust washer from drum.
5. Remove clutch pistons (3) from drum. These can be removed by pliers in countersunk holes.
6. Remove pressure plate.
7. Remove clutch release springs.

8. Remove bronze and steel clutch plates (4 steel driven plates and 5 bronze drive plates). See operation 7, "Disassembly—Rear Unit."

Assembly—Rear Unit

Use oil on clutch plates, thrust washers and bearings at time of assembly.

1. Assemble rear half of rear unit drum and rear planet carrier.
2. Clamp spline end of rear planet carrier in vise (copper or brass jaws).
3. Insert thrust bearing in rear planet carrier, making sure bearing is in good condition and drilled oil passage free of dirt or sediment.
4. Insert pilot of main shaft into thrust bearing assembly in rear planet carrier.
5. Slide front planet carrier on main shaft.

NOTE: Thrust bearing in carrier should be in good condition.

6. Install front internal gear.
7. Install clutch hub, making sure first that key and keyway are lined up and rear thrust washer is in place.

NOTE: Use heavy lubricant to stick thrust washers to hub.

8. Install clutch plates, starting with a bronze plate. Alternate bronze and steel plates ending with a bronze plate. (7 steel and 8 bronze.) If reinstalling plates, maintain original order.

NOTE: The steel plates are dished or cupped. While it is unimportant which way the dish is turned, **it is important that they all be assembled with the dish pointing the same way.** Square corner slots in steel plates fit over studs. Oil applied to clutch plates, thrust washers, bearings, etc., lubricates these parts before pump starts to operate.

9. Install clutch release springs and pressure plate. See Fig. 27. Make sure that springs are located properly in counter-bored holes in pressure plate.

10. Install thrust washer on top of clutch hub.
11. Install clutch pistons (3) in cylinders in front half of rear drum. Use screwdriver to start piston rings in cylinders.
12. Install front half of rear drum. Be sure clutch pistons in drum line up with pads built up on pressure plate. It may be necessary to index drum or pressure plate 60° to accomplish this. Compress springs by forcing halves of drum together and hold until hex. nuts are started. Tighten nuts evenly to prevent distortion.

NOTE: A slight gap between halves of drum is normal because front internal gear is bolted between two halves.

13. Install thrust washer and oil seal.

NOTE: Be sure and use narrow-faced thrust washer at this point. It should now be possible to revolve rear unit with only drag of clutch plates noticed.

14. Install oil delivery sleeve and spacer.

NOTE: Delivery sleeve is reversible.

Assembly—Front Unit

1. Install clutch plates (4 steel and 5 bronze). (See operation 8, "Assembly—Rear Unit.")
2. Install clutch release springs and pres-

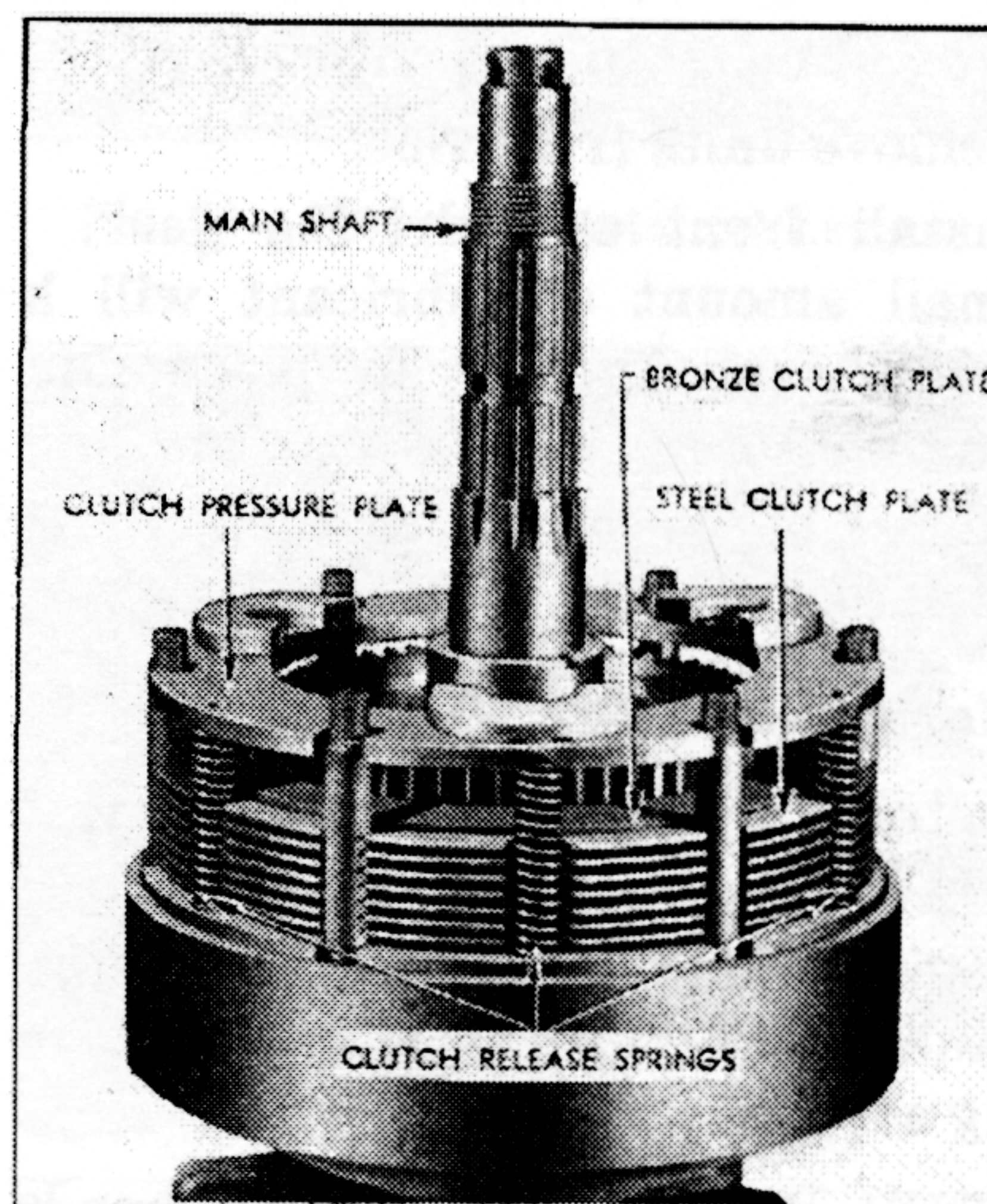


Fig. 27. Rear Unit Assembly

sure plate. (See operation 8, "Assembly—Rear Unit.")

3. Install clutch pistons (3) in cylinders in front drum. (See operation 11, "Assembly—Rear Unit.")
4. Install front drum. (See operation 12, "Assembly—Rear Unit.")
5. Install broad-faced thrust washer and oil seal ring.
6. Turn unit over and install front unit clutch hub and pinion carrier assembly.

NOTE: Rotating hub assembly forward and backward will line up bronze clutch plates, permitting clutch hub to enter. Be sure small bronze washer between center gear and clutch hub assembly is in place.

Assembly—Front and Rear Unit

1. Assemble front unit onto main shaft.

NOTE: When sliding unit down on shaft, it is necessary to hold hub assembly in place and at same time enter oil seal ring on oil delivery sleeve into bore in front drum. If hub is not held firmly in place, it may be necessary to remove the unit and line up plates again.

2. Install main shaft nut and lock. **Be sure and lock nut after it has been tightened.**

NOTE: It should now be possible to rotate both planetary units with only drag of clutch plates noticed.

3. Remove units from vise.
4. Install front unit driving gear. (A small amount of lubricant will hold ball thrust bearing in place during assembly.)
5. Install servo bands and clamp ends with tool J-1173.

Installation

1. Install units in case, using lifting tool J-1148.
2. Remove clamps, J-1173, and rotate bands into proper position on adjusting screws.

NOTE: It is necessary to place bands in proper position before fastening units

in transmission case due to limited clearance between bands and cast bosses in case.

3. Install rear bearing retainer, using gasket between retainer and case.
4. Install reverse counter gear bracket.
5. Assemble forward and reverse driven gear on front unit driving gear shaft and install shifter fork in place on forward and reverse driven gear. See operation 2, "Installation—Head Gear Set."
6. Install clutch gear, see page 18.
7. Install universal joint and torque ball assembly, see page 14.
8. Install governor, oil pump, reverse idler gear, counter gear, front and rear servos, suction pipe, oil pressure line, side cover plate (using new gaskets), control levers, oil pan, and pressure regulator valve.

NOTE: Installation procedure for above units, which should be assembled in order given, has already been described.

Service Information

Clutch plates are interchangeable between front and rear units except for number. All burrs on edges or slots should be removed with a fine file.

Clutch plates should be changed only when clutch is operating improperly (due to plates). It is not necessary to change all plates but just the damaged ones. Scored plates are not necessarily defective. The last bronze clutch plate removed when disassembling front unit should be inspected closely for scoring, because of the fact it bears on the cast-iron drive plate. If scored, this bronze plate should be replaced.

Clutch drum studs are available for service and should be replaced if worn excessively where steel plates contact. If new studs are not available at time of servicing, turning old stud 90° will help. Studs have to be removed for this operation. A horse-shoe washer and press fit keep studs in place.

When clutch pistons are removed, they should be inspected for sticking oil seal rings. Cylinders and oil passages should be cleaned out, as they act as centrifugal oil purifiers and collect dirt and other sediment.

All thrust washers except the pinion to carrier washer in front planet carrier of rear unit, are serviced separately. The pinion to carrier thrust washer is assembled behind the "riveted in" planet gears, which means that the whole unit will have to be replaced if this particular washer becomes scored or otherwise defective.

All units with welded or riveted construction, such as planet carriers, or units with tight press fits, such as the rear half of the rear unit clutch drum and bushing, are serviced only as assemblies. Clutch hubs, pressure plates, internal gears, main shaft, clutch drums, etc., are all serviced separately.

Planetary gear assemblies, which include the sun gear, planet carrier, and internal gear, are not matched in production and any or all parts may be serviced separately.

The reverse counter gear bracket is not serviced separately but is furnished as an assembly with the case.

All ball thrust bearing assemblies are interchangeable.

Reverse counter gear bracket bushing is available for service.

Control Bracket and Valve Body

Removal

1. Remove cotter keys from rear unit cam operating relay rod. Use tool J-1128 for this operation. See Fig. 28. Remove rod.
2. Loosen lock cap screws and slide three outside levers off shafts. It is not necessary to remove Woodruff keys or positioning pins.
3. Remove side plate cap screws, side plate and gaskets (3).
4. Disconnect governor relay shaft from governor assembly. See operation 4 under "Governor—Removal," page 19.
5. Remove the two slotted machine screws positioning control bracket and then remove bracket and attached linkage. See Fig. 29. The oil delivery to relay lever pipe will pull free from valve body when control bracket is removed.
6. Remove the three cap screws holding valve body to case and then remove valve body and attached linkage. See Fig. 30. After removing body, leave cap screw positioned in valve body to retain dampening valves.

Parts Available for Service

The valve body and linkage assembly is available for service as is the control bracket and levers assembly. However, some parts and sub-assemblies of the valve

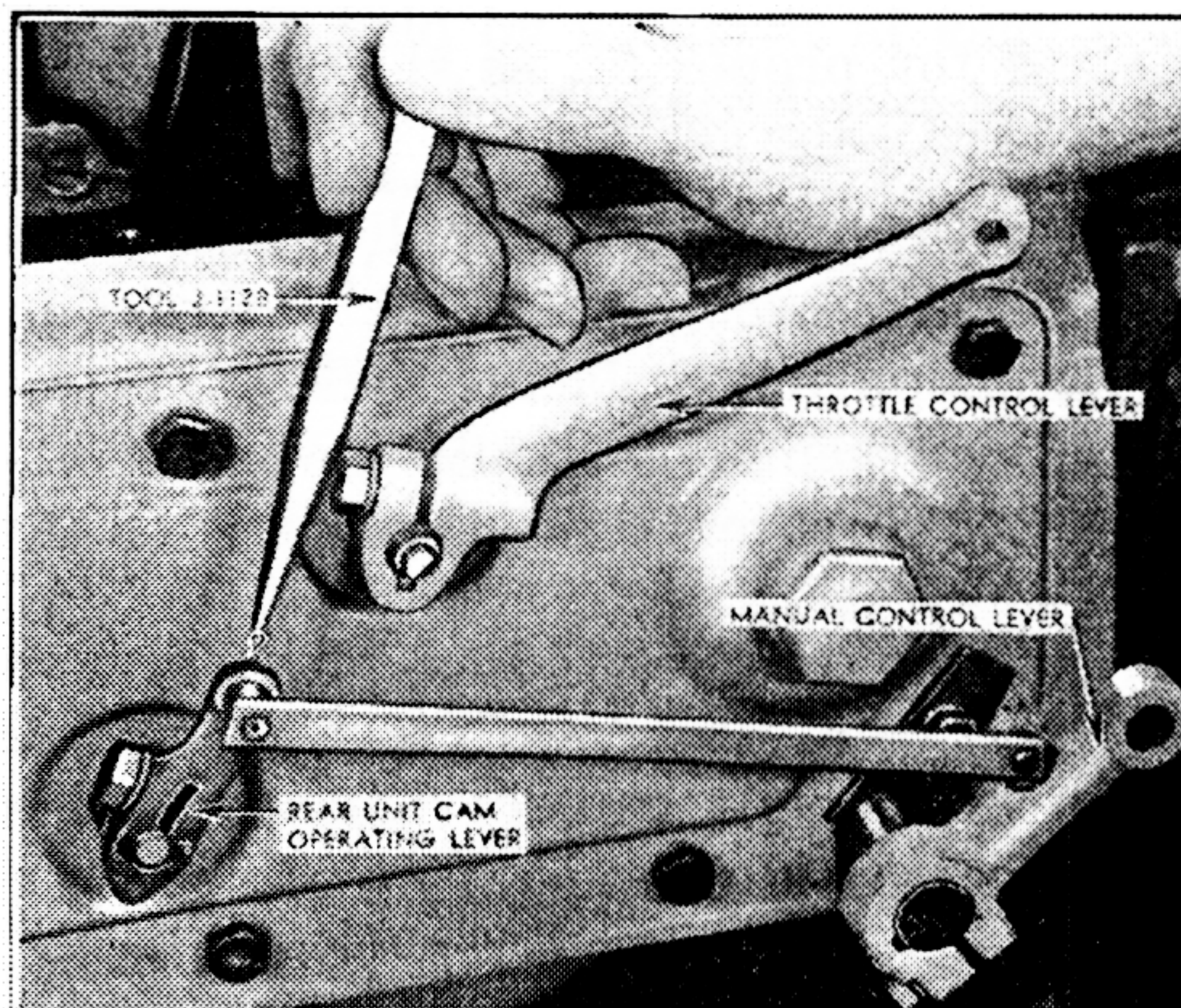


Fig. 28. Removing External Levers

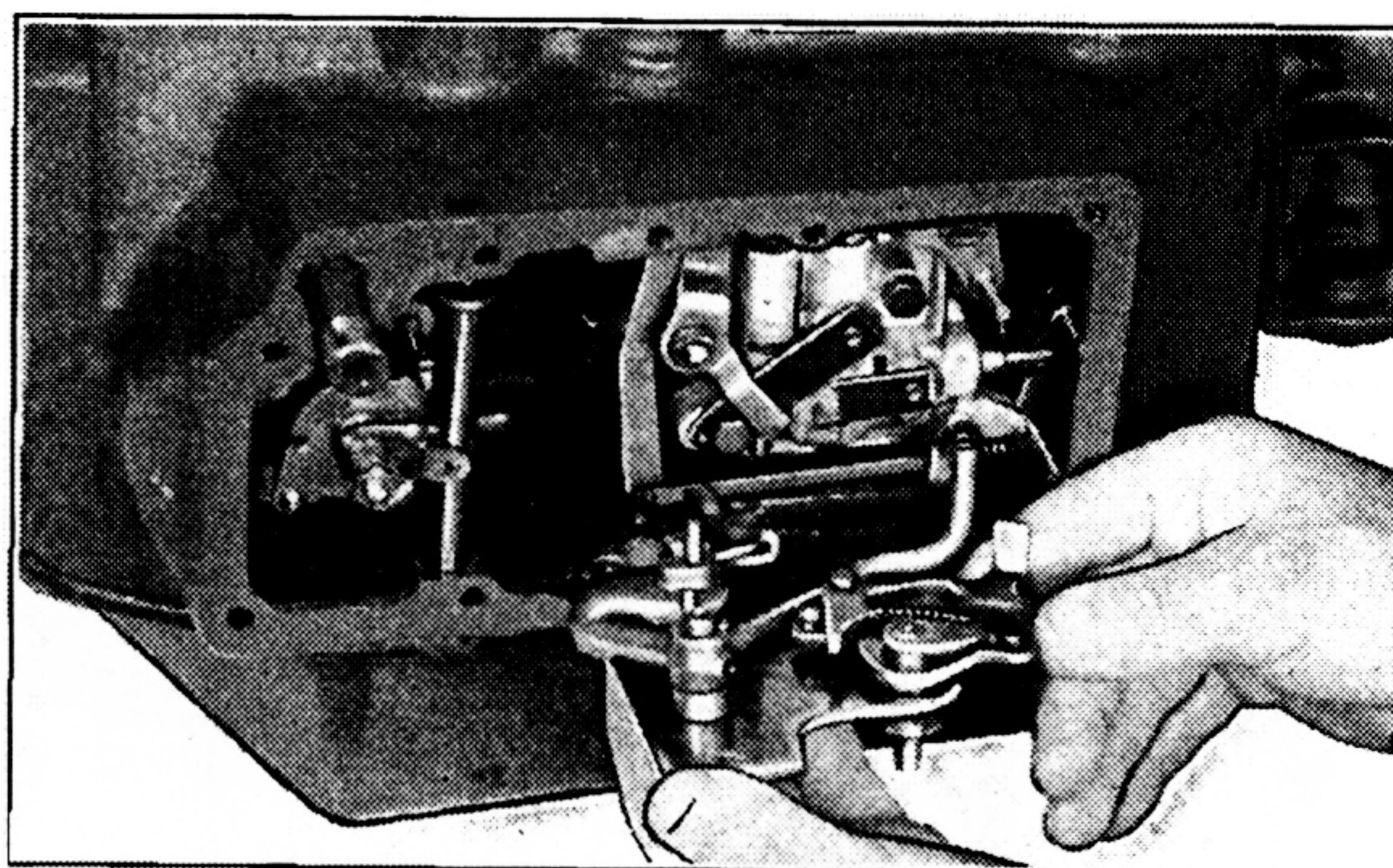


Fig. 29. Removing Control Bracket

body and linkage assembly and control bracket and levers assembly are also released for service. All plungers must be

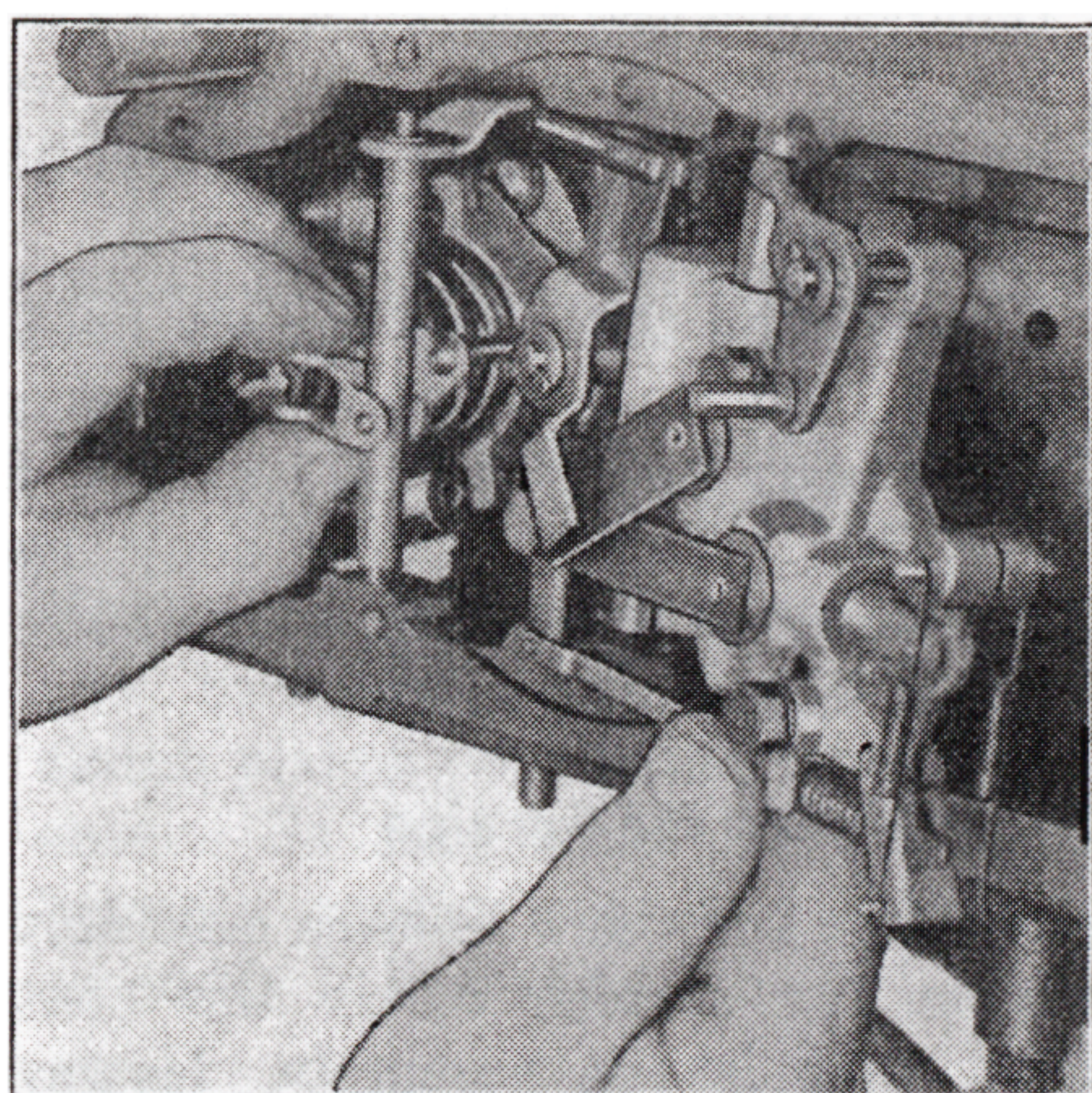


Fig. 30. Removing Valve Body

selected for proper fit, as shown in clearance chart, page 36.

The following sub-assemblies and parts have been released for service. Instruction for removing and replacing these parts follow. Sub-assemblies should never be disassembled further than necessary to replace serviceable parts.

FRONT UNIT CONTROL PLUNGER

The front unit control plunger, valve toggle springs, plunger stop pin and plunger pin are released for service. See Fig. 31. To remove these parts proceed as follows:

1. Remove valve toggle springs (two) "B."

2. Drive out front unit control plunger stop pin "C."
3. Drive out front unit valve plunger pin "D."
4. Remove front unit control plunger "A"

To reassemble, reverse above procedure. The plunger stop pin should be assembled with shoulder down. Plunger pin should be peened over on both ends.

GOVERNOR RELAY SHAFT ASSEMBLY

This assembly is serviced only as a unit. To remove this unit from remainder of linkage, drive valve control equalizer bar pin "E" out. (See Fig. 31.) When reassembling, peen over both ends of pin.

REAR UNIT CONTROL VALVE & LEVER ASSEMBLY

To remove rear unit control valve, see Fig. 31, it will be necessary to remove cotter key and slide rear unit control valve lever assembly "F" off pivot pin. Control valve "G" can then be removed. To assemble reverse foregoing procedure.

REAR UNIT THROTTLE CONTROL VALVE ASSEMBLY

This assembly "H" will slide out of valve body when control bracket is removed. Valve is serviced only as an assembly.

DAMPENING SPRING ASSEMBLIES

By removing positioning cap screw, see operation 6 under "Control Bracket and Valve Body—Removal," the internal tooth lockwasher "K," rear unit dampening spring assembly "J," dampening spring washer "L" and front unit dampening spring assembly "M" can be removed in

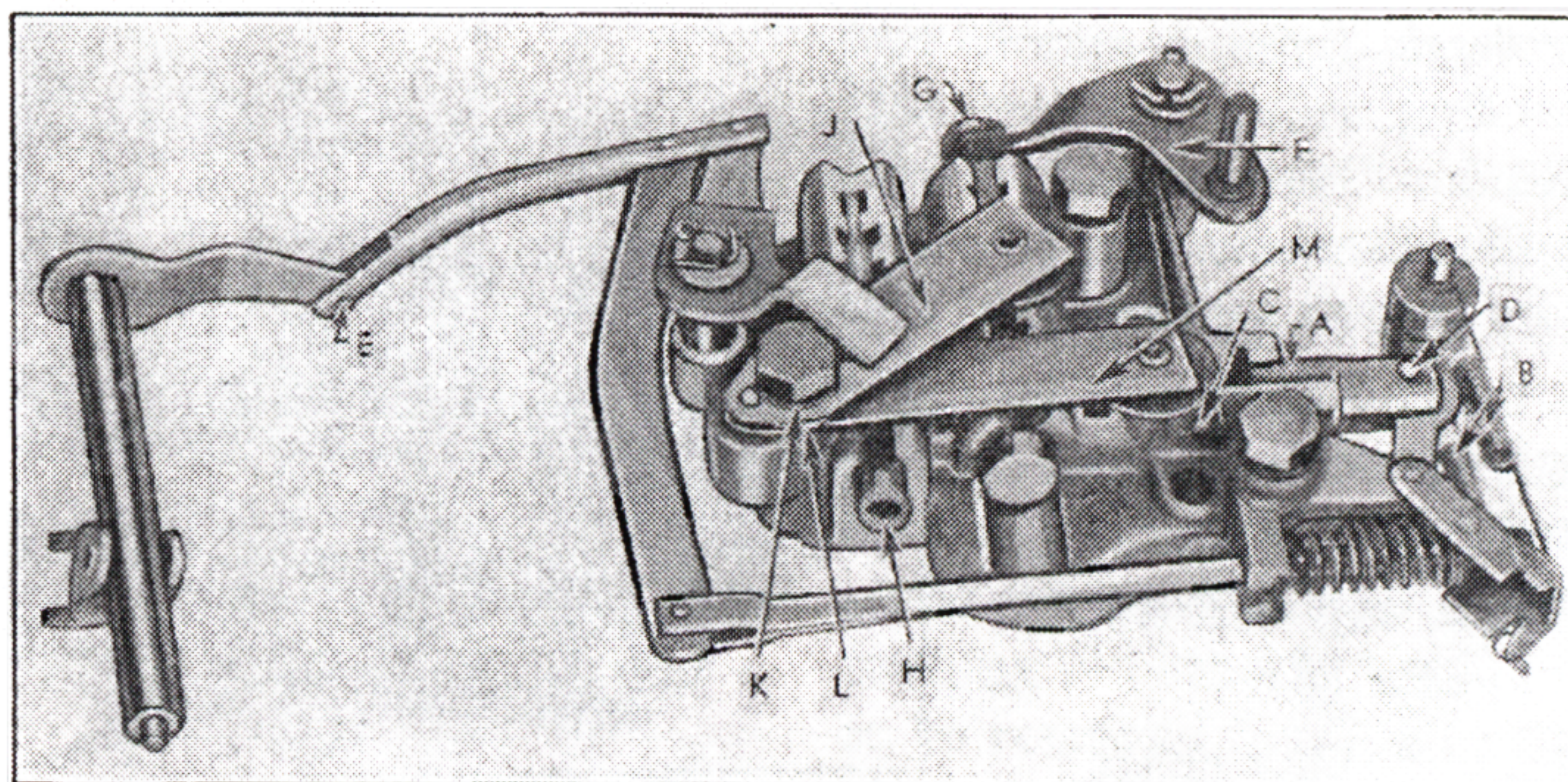


Fig. 31. Valve Body and Linkage Assembly

Outside levers, transmission case side cover, gaskets and Woodruff key are also available.

INSTALLATION

1. Shellac new gasket to front of transmission housing.
2. Screw aligner studs, tool J-1126, into two upper flywheel housing bolt holes.
3. Install clutch release bearing on retainer and place it in flywheel housing with gasket and spring washer.

NOTE: The spring washer used with Self-Shifting Transmission is part #1304037 and is "waved" instead of "cupped."

4. By means of hoist J-1129, raise transmission until clutch gear is even with opening at rear of flywheel housing, then slide transmission forward to proper location against flywheel housing, guiding it on aligner studs into clutch driven disc.

NOTE: Do not allow any weight to rest on clutch driven plate hub.

5. With hoist still in place and securely locked, install and tighten two bottom transmission to flywheel housing bolts.
6. Remove lifting tool cradle from transmission. Remove hoist.
7. Remove aligner studs.
8. Install and tighten two upper attaching bolts.

9. Retighten two lower bolts.
10. Install transmission steady rest.
11. Install clutch release yoke.
12. Reassemble flywheel pan to housing.
13. With hand shift lever in "N" (neutral) position, and shift lever on transmission in neutral, assemble transmission shift rod to transmission lever, with anti-rattle washer between clevis yoke and lever. Install cotter key and lock.

NOTE: To set shift lever on transmission in "N" position, move lever as far forward as possible by hand, then move it back one notch (2nd detent position).

14. Check throttle control lever and manual control lever settings as described under those sections.
15. Assemble speedometer cable to transmission.
16. Install floor center panel.
17. Fill transmission to "full" mark on oil level stick with correct engine oil, see page 5.
18. Install floor mat.
19. Install rear axle.
20. Jack up rear wheels in a safe manner and run transmission with shift lever in high range position. This will provide lubrication to all parts of transmission and make possible a check for oil leaks.

TROUBLE CHART

Nature of Trouble	Cause of Trouble	Correction Procedure
1. Shift lever will not move between low and high range with torque on.	Misalignment of detents at shift lever box and in transmission.	Make manual shift lever adjustment. (See page 13.)
2. Excessive vibration on accelerator pedal accompanied by a loud chatter or rattle in transmission. Most likely to occur in low range or possible in 3rd gear at high speed.	Low oil level causing oil pump cavitation.	Add oil to proper level.
3. Slight vibration on accelerator pedal and accompanied by a light buzzing sound.	Pressure regulator valve buzz. Noticeable only when oil is cold. Annoying but not serious.	No positive correction at this time. Sometimes the changing of one or all of the following parts may correct troubles: Pressure regulator valve and body or the oil pump assembly.
4. Transmission fails to manually shift from high to low range with oil cold, or shift is delayed for an unreasonable interval.	Drag of cold oil on manual control valve.	Oil too heavy for outside temperature. Change to lighter oil.
5. Transmission will not down-shift from 4th to 3rd, or it requires excessive accelerator pedal pressure to make this shift.	Improperly set throttle control lever. Throttle control rod is set too short.	Make throttle control lever setting (page 12).
6. Down-shift, 4th to 3rd, occurs before increased resistance in accelerator pedal travel is felt.	Improperly set throttle control lever. Throttle control rod is set too long.	Make throttle control lever setting (page 12).
7. Car fails to move in low or reverse gear.	Improperly set Servo brake band.	Make Servo band setting (page 11).
8. Transmission fails to shift out of low gear with shift lever in either low or high range.	No oil in transmission, pressure regulator valve tight in body. Oil pump not working. Bad oil leak inside of transmission.	Check oil level. See if pressure regulator valve is working properly. Check oil pump with pressure gauge to determine if pump is operating. Pump pressure should be approximately 85 lbs. at 1000 R.P.M. If pressure is low, inspect for leaks at pump or inside of transmission.
9. Transmission shifts rapidly and violently between 1st and 3rd gear at low speeds after prolonged driving at high speeds.	Oil in transmission may be too light for temperature and service to which transmission has been subjected.	Consult Lubrication Chart.
10. No automatic up-shift from 1st to 2nd or 3rd to 4th gear.	High unit or automatic valve not working properly. Valve may be sticking, stop pin out, or a bind in governor linkage. Faulty or defective governor.	Check front unit control valve and linkage. Free up or replace defective parts. See page 28. Replace defective governor.
11. Automatic up-shift or down-shift occurring at speeds too high or too low. Shift erratic.	Governor out of adjustment.	Adjust governor. See "Governor Setting," page 22.

TROUBLE CHART—Continued

Nature of Trouble	Cause of Trouble	Correction Procedure
12. Oil pump and governor drive gears badly worn or loose on shaft.	Improper end clearance in oil pump body. Outer drive gear (serrated) not on shaft far enough and when pump is tightened to case, the outer drive gear strikes the bracket and forces assembly out against pump cover, which will increase the driving load on the pump.	Make sure that there is only .010" clearance between pump drive gears. Make sure oil pump turns freely before installing in transmission. Two gaskets can be used between pump cover and body, also between pump and case where it is necessary.
13. Transmission fails to down-shift from 4th to 3rd above approximately 30 M.P.H. with full throttle.	Improperly adjusted throttle control lever, bent throttle control lever, or bent rear valve control lever pin.	Set throttle control lever, page 12. Straighten or replace throttle control lever. Remove control bracket and straighten rear valve control lever pin "G." See Fig. 33. (Pin should be at 90° to surface of bracket.)
14. Rattle in shift lever assembly	Linkage improperly adjusted. Too much clearance in bushings.	Adjust linkage, see page 13. Use heavy lubricant.

OIL LEAKS

A very important function of the Self-Shifting Transmission is proper control of oil in pump pipes and valves. If an oil leak occurs in any of these parts, functioning of transmission will be impaired. Oil pressure losses or leaks within transmission are usually the result of poor workmanship or poor inspection of parts. For guidance of mechanic in checking for oil leaks, some of the places where oil leaks can take place and impair functioning of transmission are listed below.

Internal

1. Pressure regulator valve body loose on pump body.
2. Pressure regulator valve loose in valve body, allowing too much clearance.
3. Leaks in oil pressure line (oil pump to servo).
4. Servos loose on transmission case.
5. Plugs out of servos.
6. Dirt or foreign matter between servos and transmission case will cause a bad oil leak.
7. Throttle control relay lever having too much clearance on the pivot shaft.

8. Improperly fitting oil line, oil control unit to relay lever. (This pipe should be a tight fit at both ends.)
9. Oil control unit loose on transmission case.
10. Too much clearance between throttle control valve and body.
11. Damaged or loose oil delivery pipes.
12. Worn or broken oil seal rings on the oil delivery sleeve.
13. Air leak between oil pump cover and pump body.

External

1. Sand holes in oil pump cover casting.
2. Poorly fitting pipe plug ($\frac{1}{8}$ ") in pump cover.
3. Loose oil pan cap screws or damaged oil pan gasket.
4. Loose oil pump to transmission case cap screws.
5. Transmission to flywheel housing gasket installed wrong way. This will close off the oil return hole to transmission.
6. Side cover plate cap screws loose or gasket damaged.

ANALYSIS OF SHIFTING

UP SHIFTS

First to Second

Control lever in low range.

Shift occurs when governor distends sufficiently to trip open governor controlled valve.

With minimum throttle, governor control valve trips and directs oil to front planetary unit, releasing servo band and engaging clutch. (When engine speed reaches approximately 1800 R.P.M.—10 M.P.H.)

With full throttle, cam "E" (see Fig. 34) on throttle controlled valve lever moves fulcrum point on equalizer bar "H" forward to a position where more governor travel (higher speed) is required to trip governor controlled valve. Under this condition shift does not occur until engine speed reaches approximately 2500 R.P.M. (22 M.P.H.)

First to Third

Control lever in high range.

Shift occurs when oil pump has built up sufficient capacity or pressure to lift pressure regulator valve which directs high pressure oil to valve body. Manual controlled valve, which is open when control lever is in high range, directs oil to rear planetary unit, releasing servo band and engaging clutch.

This shift is strictly an oil pressure shift and is not affected by throttle position.

DOWN SHIFTS

Second to First

Control lever in low range. This is a governor controlled valve shift.

When engine speed drops to approximately 700 R.P.M. (7 M.P.H.) governor contracts and trips governor controlled valve, cutting off oil from front planetary unit. Servo band engages and clutch releases.

Under full throttle conditions, with car decelerating, as on a steep grade or pulling through deep sand, etc., cam "E" on throttle controlled valve lever moves fulcrum point on equalizer bar "G" forward (see Fig. 34) causing governor to trip governor controlled valve sooner, or at an engine speed of approximately 1100 R.P.M. (11 M.P.H.)

Third to First

Control lever in high range. This is an oil pump pressure regulator valve shift.

With car decelerating, at an engine speed of approximately 200 R.P.M. (3 M.P.H.) oil pump pressure regulator valve drops, cutting off oil to both planetary units. Servo bands engage and clutches are released.

NOTE: Excessive leakage in oil pump assembly or regulator valve, or an improper regulator valve spring, will cause shift at a higher speed. When this shift occurs at speed where governor opens governor controlled valve, "hunting" between 1st and 3rd will occur.

UP SHIFTS**Third to Fourth**

Control lever in high range.

Shift occurs when governor distends sufficiently to trip open governor controlled valve.

With minimum throttle, this will occur about 22 M.P.H. (1350 engine R.P.M.)

While this is the same governor shift which occurs from 1st to 2nd speed, the delayed action of the 3rd to 4th shift when accelerator is partly depressed is accomplished as follows: (See Fig. 35)

When the manual control lever is in the high forward range oil is admitted by manual controlled valve to pipe line "A," thence to pivot pin "B" into relay valve "C" through hollow relay valve arm to piston "D" which moves outward .140". This piston pushes against cam "E" on throttle control valve lever, moving relay away from cam. Fulcrum pin "F" on relay pushes equalizer bar "G" forward to a position where more governor speed is required to trip the valve open than was the case in the 1st to 2nd shift when the relay was cut off from oil pressure due to position of the manual controlled valve.

If accelerator is depressed to toe board cam "E" on the throttle controlled valve lever moves the fulcrum point further forward and governor cannot trip valve until a car speed of 63 M.P.H. (3750 eng. R.P.M.) is reached.

Shift will also occur at any car speed between 22 M.P.H. and 63 M.P.H., depending on throttle position; that is, the distance fulcrum pin "F" is moved forward due to movement of cam "E" on throttle control valve lever.

DOWN SHIFTS**Fourth to Third**

Control lever in high range. This is a governor controlled valve shift.

With car decelerating, governor contracts and trips governor controlled valve at approximately 700 engine R.P.M. (16 M.P.H.) with minimum throttle. This cuts off oil to front planetary unit, engaging servo band and releasing clutch.

If engine speed is below 2500 R.P.M. (58 M.P.H.) and above 700 R.P.M. (16 M.P.H.) and accelerator pedal is pressed to toe board, cam "E" (see Fig. 35) on throttle controlled valve lever will move fulcrum point of equalizer bar "G" forward, causing governor controlled valve to trip to closed position.

UP SHIFTS**Second to Third**

Shift control lever from low to high range. This is a manual controlled shift.

Moving control lever opens manual controlled valve which directs oil to rear planetary unit, releasing servo band and engaging clutch. With rear unit operating in direct drive, governor is slowed down, causing governor controlled valve to close, shutting off oil to front planetary unit. This releases clutch and engages band. *Momentarily, while governor is slowing down and tripping valve, transmission operates in 4th gear.*

This shift will occur on part throttle up to 22 M.P.H. and on full throttle up to approximately 63 M.P.H. (If manual shift is made above 22 M.P.H., part throttle, governor speed holds valve open, causing transmission to operate in 4th gear.)

Second to Fourth

Shift control lever from low to high range. This is a manual controlled shift.

This shift occurs when manual control valve is opened by control lever at any speed above 22 M.P.H., part throttle. Manual control valve directs oil to rear planetary unit, releasing servo bands and engaging clutch. (Front servo band is already released and clutch engaged.)

NOTE: Under full throttle conditions, or under part throttle below 22 M.P.H., governor controlled valve will cause shift to 3rd.

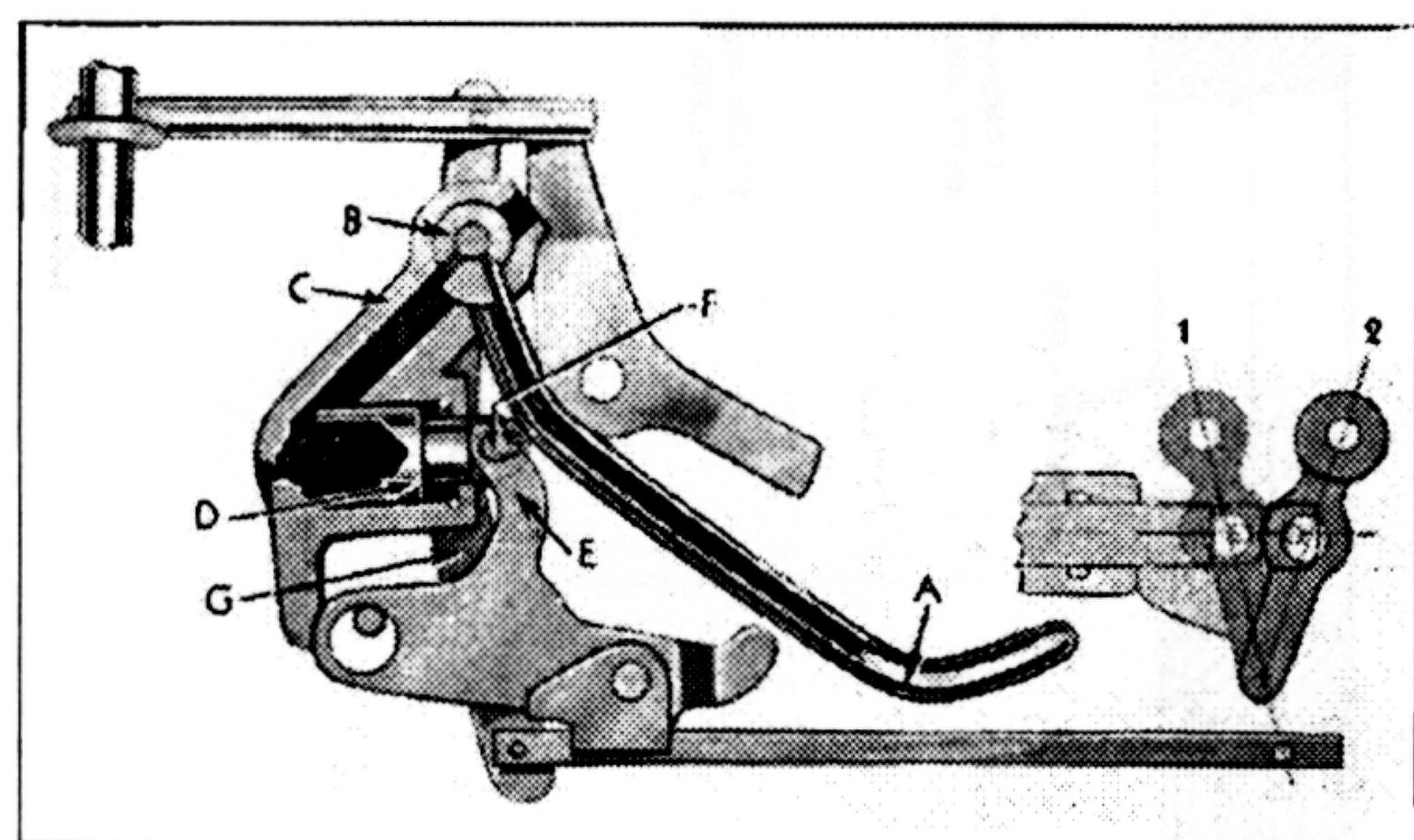


Fig. 34. Relay Valve, Low Range

DOWN SHIFTS**Third to Second**

Shift control lever from high to low range. This is a manual controlled valve shift.

Moving manual controlled valve cuts off oil to rear planetary unit and causes band to engage and clutch to release. The increased R.P.M. of governor, due to reduction action of rear unit, causes governor controlled valve to trip open, directing oil to front planetary unit. Servo band releases and clutch engages.

At approximately 2400 engine R.P.M. (55 M.P.H.) manual controlled valve is locked by a "lock out" lever attached to governor linkage and valve will not move even though hand control lever is shifted. Therefore, shift cannot occur until speed drops to this point.

Fourth to Second

Shift control lever from high to low range. This is a manual controlled valve shift.

Moving manual controlled valve cuts off oil from rear planetary unit, causing band to engage and clutch to release.

At approximately 2400 engine R.P.M. (55 M.P.H.) manual controlled valve is locked by a "lock out" lever attached to governor linkage and valve will not move even though hand control lever is shifted. Therefore, shift cannot occur until speed drops to this point.

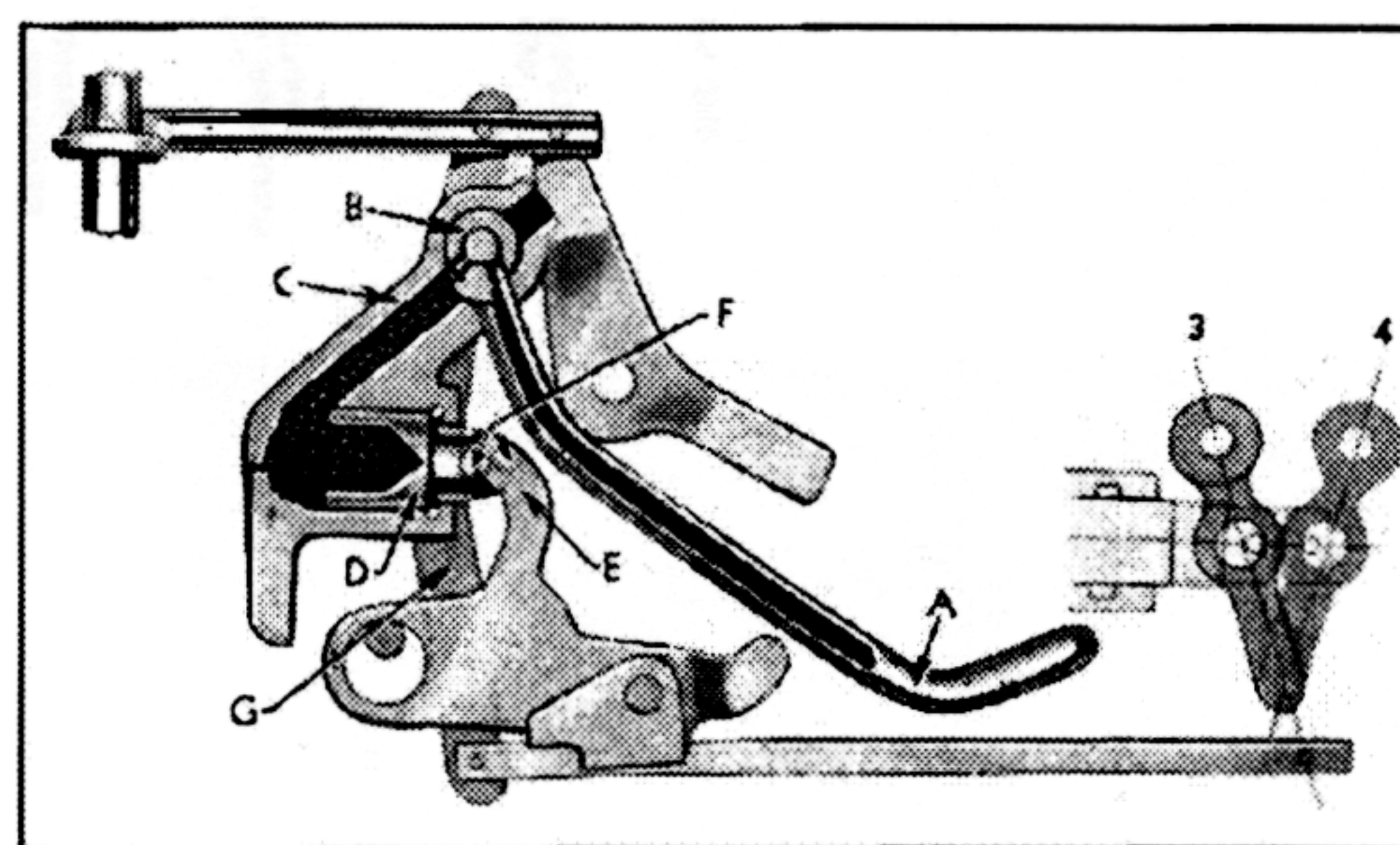


Fig. 35. Relay Valve, High Range

CLEARANCES

Oil Pump—Double Drive Type

Secondary drive gear shaft to pump cover bushing..	.001" - .002"
Gear O.D. to case I.D.	.004" - .007"
Idler shaft to idler gear bushing	.001" - .0025"
Oil pump body bushing to primary drive gear.....	.0000" - .0015"
Governor shaft bushing to secondary drive gear shaft	.0015" - .003"

Transmission—General

Reverse idler gear bushing to shaft	.002" - .0035"
Reverse counter gear bush- ings to shaft.....	.002" - .0035"
Front unit driving gear pilot to clutch gear bush- ing	.0015" - .0035"
Front unit driving gear to reverse counter gear bracket bushing	.0032" - .0047"

Main shaft pilot to front unit driving gear bush- ing	.001" - .003"
Front unit sun gear bush- ing to main shaft.....	.0022" - .0037"
Oil delivery sleeve to spacer	.002" - .004"
Rear unit clutch hub to front half rear drum bushing	.0015" - .0035"
Rear unit front planet car- rier to clutch hub.....	.032" - .035"
Rear half rear drum bush- ing to rear planet car- rier	.001" - .003"
Rear planet carrier bush- ing to main shaft pilot....	.001" - .003"
Torque ball bushing to U- joint	.004" - .006"
All plungers to body	.0008" - .0015"
Throttle control relay lever to shaft	.0005" - .0025"

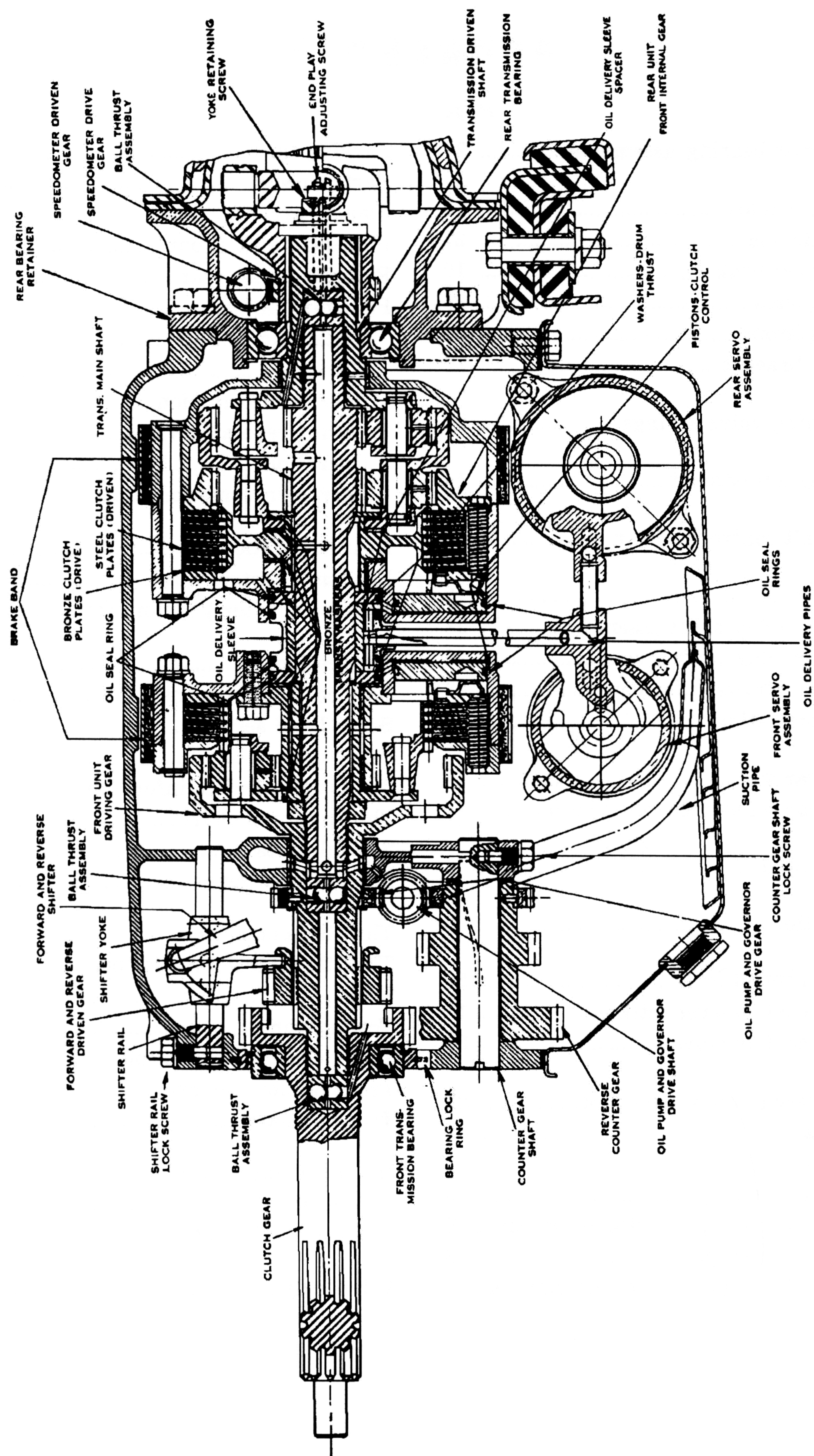


Fig. 36. Self-Shifting Transmission Assembly Information Drawing

INDEX

	<i>Page</i>		<i>Page</i>
Ball thrust bearing assemblies.....	27	Parking car	5
Clearance chart	36	Parts, special	3
Clutch drums	27	Planet carriers	27
Clutch gear brake	10	Planetary unit, front	24
Clutch plates	26	Planetary unit, rear	24
Clutch pistons	27	Planetary units—	
Control bracket	29	Installation	26
		Removal	23
Dampening valve springs	28	Service information	26
End-play adjustment	14	Pressure regulator valve.....	6
		Operation	8
Front unit control plunger.....	28	Service information	6
Governor	19	Rear axle ratios.....	15
Governor relay shaft assembly.....	28	Rear unit control valve.....	28
Governor relay shaft pivot.....	29	Reverse counter gear bracket.....	27
Governor service information.....	22	Service tools	3
Governor setting	22	Service transmissions	15
Head gear set	17	Servo band setting	11
Head gear set service information	18	Servo units	10
Idling speed	5	Servo units service information	12
Lubrication	5	Shift analysis chart	33
Manual control lever	27	Special parts	3
Manual control lever setting	13	Speedometer gears	15
Manual control valve	28	Throttle control lever	27
Oil delivery to relay lever pipe.....	29	Throttle control lever setting.....	12
Oil leaks	32	Tools	3
Oil pump—		Towing car	5
Double drive type	6	Transmission, installation	30
Double drive type service information	8	Transmission, removal	16
Single drive type	8	Trouble chart	31
Single drive type service information	10	Universal and ball joint—	
		Assembly	14
		Service information	15
		Valve body	27

MEMORANDA

MEMORANDA